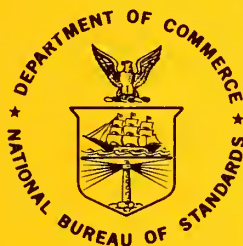


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NBS Communications Manual for Scientific, Technical, and Public Information



NATIONAL BUREAU OF STANDARDS*

The National Bureau of Standards¹ was established by an act of Congress on March 3, 1901. The Bureau's overall goal is to strengthen and advance the Nation's science and technology and facilitate their effective application for public benefit. To this end, the Bureau conducts research and provides: (1) a basis for the Nation's physical measurement system, (2) scientific and technological services for industry and government, (3) a technical basis for equity in trade, and (4) technical services to promote public safety. The Bureau's technical work is performed by the National Measurement Laboratory, the National Engineering Laboratory, and the Institute for Computer Sciences and Technology.

THE NATIONAL MEASUREMENT LABORATORY provides the national system of physical and chemical and materials measurement; coordinates the system with measurement systems of other nations and furnishes essential services leading to accurate and uniform physical and chemical measurement throughout the Nation's scientific community, industry, and commerce; conducts materials research leading to improved methods of measurement, standards, and data on the properties of materials needed by industry, commerce, educational institutions, and Government; provides advisory and research services to other Government agencies; develops, produces, and distributes Standard Reference Materials; and provides calibration services. The Laboratory consists of the following centers:

Absolute Physical Quantities² — Radiation Research — Thermodynamics and Molecular Science — Analytical Chemistry — Materials Science.

THE NATIONAL ENGINEERING LABORATORY provides technology and technical services to the public and private sectors to address national needs and to solve national problems; conducts research in engineering and applied science in support of these efforts; builds and maintains competence in the necessary disciplines required to carry out this research and technical service; develops engineering data and measurement capabilities; provides engineering measurement traceability services; develops test methods and proposes engineering standards and code changes; develops and proposes new engineering practices; and develops and improves mechanisms to transfer results of its research to the ultimate user. The Laboratory consists of the following centers:

Applied Mathematics — Electronics and Electrical Engineering² — Mechanical Engineering and Process Technology² — Building Technology — Fire Research — Consumer Product Technology — Field Methods.

THE INSTITUTE FOR COMPUTER SCIENCES AND TECHNOLOGY conducts research and provides scientific and technical services to aid Federal agencies in the selection, acquisition, application, and use of computer technology to improve effectiveness and economy in Government operations in accordance with Public Law 89-306 (40 U.S.C. 759), relevant Executive Orders, and other directives; carries out this mission by managing the Federal Information Processing Standards Program, developing Federal ADP standards guidelines, and managing Federal participation in ADP voluntary standardization activities; provides scientific and technological advisory services and assistance to Federal agencies; and provides the technical foundation for computer-related policies of the Federal Government. The Institute consists of the following centers:

Programming Science and Technology — Computer Systems Engineering.

¹Headquarters and Laboratories at Gaithersburg, MD, unless otherwise noted; mailing address Washington, DC 20234.

²Some divisions within the center are located at Boulder, CO 80303.

*This brief description of NBS and of the NBS technical publication series appear on the inside of the front and back covers of most of the Bureau's published output.

NBS COMMUNICATIONS MANUAL FOR SCIENTIFIC, TECHNICAL, AND PUBLIC INFORMATION

Edited by
Carol W. Solomon and Randall D. Bograd
Writing Consultants
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National Bureau of Standards

*Chapter 15 of the NBS Administrative Manual

This Manual is based on material prepared by an Ad Hoc Committee consisting of Edward Brady, Robert Parker, Carl Muehlhause, Sam Chappell, Reeves Tilley, Robert Blunt, Paul Campbell, Dick Franzen, Gordon Day, and Ralph Desch. It supersedes the NBS Publications and Reports Manual of June 1969 (and subsequent changes), and Chapter 15, dated 1968 through 1976, of the NBS Administrative Manual.

For Official Distribution / November 1980

U.S. Department of Commerce

How this Manual was produced

This document is a product of advanced publishing technology—electronic typesetting—readily available to the NBS staff for producing high quality publications. Also called phototypesetting or photocomposition, this modern production technique was applied by the Technical Information and Publications Division (TIPD) as follows:*

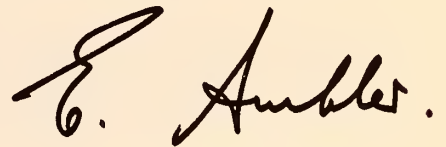
- the manuscript was keyboarded (automated) into the NBS computer along with the necessary typesetting codes using the Ed Text editing system—
- using the NBS-developed typographic program, a magnetic tape was produced that drove, directly, the advance Government Printing Office (GPO) photocomposition equipment to produce high-quality camera-ready copy—
- following page make-up, GPO published the final document.

The NBS Visual Arts staff of the Office Management Division provided the artwork for the *Manual*. The text is set in 10-point Times Roman type with pages “perfect” bound and three-hole punched for ease of inserting subsequent revisions. The cover paper stock is vellum sub 100 weight, the text is offset white sub 120.

*See sections 3.6 and 3.7 for details of how this technique is utilized for NBS publications.

Foreword

This updated manual sets forth the policies and procedures for NBS communications. It is an important document for it fosters and guides the transfer of information, a necessary step if NBS work is to have timely impact. Since communicating is vital, I recommend that you become acquainted with the manual's content. Don't be put off by the length—it is well written and has an excellent index for easy reference. Keep it handy and use it to improve the flow of information to our peers and clientele.

A handwritten signature in black ink, reading "E. Ambler." The signature is fluid and cursive, with a large initial "E" and a period at the end.

Ernest Ambler
Director

Preface

This manual should answer most questions about the policy, procedures, and administrative requirements for communicating the results of NBS work. For answers not found in the manual, in Gaithersburg contact either the Technical Information and Publications Division or the Public Information Division. In Boulder, contact the Program Information Office.

The manual is designed to serve the needs of diverse groups at NBS: authors, reviewers, administrators, editors, and secretaries. For that reason the manual consists of five self-contained chapters, each of which, with one exception, addresses the needs of primarily one or two groups. Each chapter contains the information pertinent to its subject, including bibliographies and exhibits.

The five chapters and the groups whose needs they address are:

Chapter 1 NBS Communications System: Functions and Policies

(authors, reviewers, administrators, and editors)

Chapter 2 Writing for Publication

(authors, reviewers, and editors)

Chapter 3 Selecting a Publication Medium and Method of Composition

(authors, reviewers, and administrators)


Chapter 4 Mechanics of Manuscript Preparation

(secretaries and the clerical staff)

Chapter 5 Special Forms of Communication

(administrators, scientists, and engineers)

The detailed index at the back of the manual and the extensive table of contents at the start of each chapter should help the reader find answers to specific questions.



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Chapter 1

NBS Communications System: Functions and Policies

This chapter is a reference for authors, reviewers, administrators, and editors, who are seeking answers to policy questions or deciding whom to consult for assistance.

1.1 Overview of NBS Communications System

Communicating the results of NBS research is an important part of the Bureau's mission. To transmit results of activities and accomplishments to individuals and groups inside and outside the Bureau, NBS produces 2 technical periodicals, 1 public information periodical, 10 nonperiodical series, and interagency and grant/contract reports (see ch. 3). Also, Bureau authors publish articles in professional and technical journals, contribute to non-NBS books, make oral presentations at various meetings, and use other special forms of communication as described in chapter 5. In addition, the Bureau answers numerous general inquiries, releases information to specialized and public media, and sponsors conferences, workshops and symposia.

In Gaithersburg, two divisions are responsible for assisting the staff to communicate effectively: Technical Information and Publications Division (TIPD) and Public Information Division (PID). Basically, TIPD manages the technical publications and technical inquiries while PID manages special programs, general publications, internal publications, contacts with the media, and audiovisual productions.

In Boulder, the Program Information Office (PIO) is responsible for all these functions.

To assist the staff to maintain the highest possible quality of content and style in NBS-authored articles and books, the Director has established three Editorial Review Boards. They are the Washington Editorial Review Board (WERB), the Boulder Editorial Review Board (BERB), and the Joint Institute of Laboratory Astrophysics Editorial Review Board (JERB) (see exh. 1-A).

The Director has also established advisory boards for the NBS periodicals (see exh. 1-B).

1.2 General Policy

NBS has and must maintain an outstanding reputation among scientific and technical laboratories for doing good work and for communicating its results effectively. It is the policy of the Director to hold the heads of the major operating units (MOUs) responsible for the quality of the work done in their organizations. Much of the management process of NBS is devoted to ensuring that NBS selects high priority projects and carries them out at the highest level of technical competence.

The staff must report the results of projects promptly and effectively. Reports are normally reviewed critically several times before they are released to potential users of the information. Poor work cannot be converted to good work by effective presentation, but good work can achieve greater impact and usefulness through quality presentation.

NBS must communicate its accomplishments broadly as well as accurately. Special staff resources help the NBS staff to communicate through various media to the public-at-large. The specific responsibilities and functions of the staff are pointed out in this manual. However, the scientific and technical staff also must keep in mind the need to tailor the style and content of their communications to their intended audiences. People of different interests and different levels of technical background are often served by the same information. The essential content of a technical paper written for a highly technical audience usually must be presented in a quite different way for the general public or for regulators and legislators.

The Bureau cannot escape responsibility for the statements and publications of any individual staff member; both in an individual and collective sense, each person's professional activity reflects and shapes the reputation of the Bureau.

A release is therefore required from the NBS Director or the MOU directors or the appropriate editorial review board before official writing by an NBS staff member may be published. This requirement applies to writings that identify authors in their official Bureau capacity, and should be considered by the staff when making general public

statements that might affect the welfare or reputation of the Bureau. The responsibility for observing and adhering to the Bureau's editorial policies and practices is shared by all members of the staff; any violations should be reported to the ERB and may result in appropriate administrative action.

The chairpersons of the Editorial Review Boards, either in Gaithersburg or in Boulder, are the delegates of the Director (see exh. 1-A). These Editorial Review Boards exercise policy, editorial, and technical review. If an Editorial Review Board is unable to approve a paper for publication, the author will be advised of an appeal mechanism (usually through the appropriate line management to the MOU Director).

1.3 Review and Approval Procedures

The basic policy underlying the entire review process is that the MOU directors are held responsible by the NBS Director for the quality of the publications of their organizations. Traditionally, a two-stage review process has been used to help the MOU directors fulfill this responsibility: first, a review by the originating organization, and second, a review by a Bureau-wide Editorial Review Board (ERB) using individuals not personally involved in the work and its reporting (to the maximum extent possible).

For all Gaithersburg papers, release authority has been delegated to the chairperson of WERB. For Boulder papers, such authority has been delegated to the chairpersons of the BERB and the JERB (for a description of ERB responsibilities and memberships, see exh. 1-A).

1.3.1 Types of Review

All technical manuscripts (except those prepared for use in PID publications) undergo essentially the same review procedures and involve participation of NBS personnel at several levels. Three types of review are routinely conducted, and a fourth is conducted when appropriate.

- (1) Technical review—includes critical evaluation of the technical content and methodology, statistical treatment of data, error analysis, use of appropriate reference data and units;
- (2) Policy review—includes examination of consistency with NBS statutory authority and operating policy, appropriateness of selected medium of publication, and other matters as appropriate;
- (3) Editorial review—includes a check on nomenclature, formatting, titling, references, indexing, citations, footnotes, acceptable standards of writing quality, correct data on Form NBS-114

(Manuscript Review and Approval Form) and Form NBS-114A (Bibliographic Data Sheet); and

- (4) Legal review when appropriate.

1.3.2 Stages of Review

The diagrams in exhibits 1-C and 1-D outline the stages of the review process in Gaithersburg and Boulder. An instruction sheet accompanying Form NBS-114 further details the stages of the review process (see exh. 1-E(a)). Note that the review process within each MOU is established by the director of that MOU, who may in turn delegate the responsibility to the center/division directors.

The following sections 1.3.3 through 1.3.10 cover specifically the review process for the organizational levels in Gaithersburg; however, the principles and responsibilities also apply to the modified review process in Boulder (exh. 1-D).

1.3.3 Author Responsibilities

The author has the primary responsibility for the technical content and the quality of exposition of the manuscript. Thorough review at the originating level is vital (see Checklist for Authors and Reviewers, exh. 2-A). When the manuscript is finished and ready for review, the author carefully fills out appropriate portions of Form NBS-114 and Form NBS-114A (see exh. 1-E(a) and 1-E(b)). Form NBS-114A becomes an integral part of an NBS-published paper and must accompany all non-NBS media papers entered into the National Technical Information Service.

One copy of the manuscript and the original and one photocopy of Form NBS-114 and Form NBS-114A are sent through the review process.

1.3.4 Center and Division Responsibilities

The center director may establish a center editorial review process or may delegate responsibility for review and recordkeeping to division chiefs. If delegated the review responsibility, the division chief then carries out, or causes to be carried out, a complete review of the manuscript. Suggestions for qualified critical readers for ERB are encouraged, including suggestions from the author (criteria for reader selection are given in sec. 1.3.7). Form NBS-265 (Publications Followup Office Record, exh. 1-E(e)) should be initiated for each manuscript at the time that the Form NBS-114 is prepared. Form NBS-265 and Form NBS-266 (Notice of Publication in Non-NBS Media, exh. 1-E(f)) can serve as a checklist and record of manuscript progress, publication, and reprinting. These forms, along with photocopies of Form NBS-114, are useful center and division records.

When papers have authors from more than one center or division, the center and division of the principal author (first named) shall ordinarily assume responsibility for initiating review. That center/division shall verify that approvals and clearances have been obtained from authors and managers in other organizational units. Signatures or initials indicating such review may be shown along with those of the originating center/division.

Upon completion of the center/division review, if further review is not required by the director of the MOU, the manuscript is sent to the appropriate ERB, together with any special notes and the original and one copy of Form NBS-114 (Manuscript Review and Approval Form) and Form NBS-114A (Bibliographic Data Sheet) (see sec. 1.3.5 for circumstances when MOU review is required).

The center/division is encouraged to send to the ERB names of suggested readers in other than the originating center and division. Although the ERB is not obligated to choose these readers, the information is useful to the Board and often aids in reducing total review time. Also of great interest to ERB are the names of additional readers used in the center/division review. Space is provided on Form NBS-114 for additional readers, and such evidence of unusually thorough review will often prevent duplication of effort and expedite ERB review. Names of additional readers and other special circumstances can also be provided in a memorandum accompanying the manuscript.

1.3.5 MOU Responsibilities

To assist the directors of the MOUs in ensuring high quality technical papers originating within their organizations, the directors may either establish an editorial review committee at the MOU level or delegate review authority for certain types of papers to the center/division levels as discussed in the previous section. These options, if exercised, do not abrogate the MOU director's ultimate responsibility for these papers.

Moreover, the MOU director must personally approve any paper that:

- (1) Reports new values or methods for determination of basic physical standards or fundamental constants; or
- (2) Reports material likely to draw conspicuous public attention to NBS, such as evaluation of commercial products and other sensitive matters.

1.3.6 Editorial Review Boards

The ERBs serve as instruments of the Director of NBS and the directors of the MOUs to review all manuscripts other than those for which the Public Information Division is responsible (see sec. 1.7 and

ch. 5). Detailed review by the ERB will normally follow review and approval by the originating organization.

The ERB procedures call for normal processing of manuscripts that arrive with signatures of at least one line manager and at least one technical reviewer. Generally, the ERB assigns one technical reader to review the paper and one ERB member to serve as sponsor for the paper.

Upon the satisfactory completion of the ERB review—usually within 2 to 4 weeks—the ERB chairperson releases a manuscript for publication.

In all cases, the regional ERB maintains complete records of papers produced in its area, and TIPD maintains centralized records for all NBS technical outputs. Form NBS-114, Form NBS-114A, Form NBS-266 (Notice of Publication in Non-NBS Media), along with appropriate memorandums are used to form the principal entries in these files.

1.3.7 Readers

Although one reader can perform multiple functions, different readers may be necessary to meet the requirements of technical, policy, editorial, and, when appropriate, legal review. On the center/division level the emphasis of the reader(s) is usually on technical content; although all NBS requirements are considered. On the ERB level the emphasis of the reader(s) is on NBS policy and editorial practices as well as technical content.

Technical review includes at least one reader (either inside or outside the Bureau) who is totally independent of the research leading to the manuscript.

Policy review is carried out by a reader who is familiar with NBS statutory authority and operating policy and with the nature and appropriateness of the planned publication outlet.

Editorial review is the responsibility of the author and all readers; they must be familiar with NBS editorial and publication practices and with the provisions of this manual.

Legal review is carried out by the NBS legal advisor when such review is requested by the center director, the MOU director, or the ERB.

Readers are selected from the author's own field or a related field. Their primary function is to provide an independent judgment of the value of the paper, as well as how successfully the paper communicates its message to its potential audience. They have knowledge of the field concerned, and at least a potential interest in the findings, but they should not be so closely connected with the work to reflect a vested interest. The ERBs, MOUs, and the centers/divisions welcome suggestions of qualified readers from authors and managers.

All members of the Bureau's professional staff are expected to accept reviewing assignments within their fields of competence, unless they are

prevented from doing so by the pressure of urgent business.

The ERB readers are urged to confer directly with authors of papers on suggested changes or any questions on content. However, the reader can remain anonymous if desired. In that case, the reader can send the author unsigned comments via the ERB sponsor or the secretary of ERB.

The ERB reader, on completing the review, signs Form NBS-214¹ (Manuscript Evaluation, exh. 1-E(c)) and Form NBS-114 (Manuscript Review and Approval), fills out the manuscript custody transfer blanks, and sends the entire package of manuscript and forms to the ERB sponsor whose name and address appear on Form NBS-214.

The ERB reader should complete the review within 2 weeks, or sooner if possible. If it appears that additional time will be required, the reviewer should notify the originating organization or the secretary of ERB.

Readers should consult the Checklist for Authors and Reviewers in exhibit 2-A.

1.3.8 Sponsors

The ERB sponsor is a member of the ERB who helps coordinate the final review of the paper. The ERB members are familiar with NBS policy and editorial criteria, and as sponsors put primary effort on these aspects of review. The sponsor serves as the final reader of the paper, though this review is usually not in as great detail as that done by the other readers. In addition, the sponsor serves as an arbiter for points of difference between the author and the ERB reader when necessary. Sponsors present their recommendations and assessment of manuscripts at ERB meetings.

1.3.9 Editorial Review Board Actions

When the manuscript has been approved by the ERB and released for publication by the chairperson, the secretary of ERB notifies the author by memo through the center/division director (or authorized designee). At the same time, the manuscript is returned to the originator for final corrections to the manuscript prior to submission for publication. All manuscripts for NBS publication series (including the NBS Journal of Research) and for all non-NBS media are handled in this manner. Review and related ERB processing are normally completed within 2 to 4 weeks.

If the ERB cannot release a manuscript (for technical or other reasons), it is returned to the originating organization for reconsideration. When differences between ERB and the originating organization cannot be resolved, the manuscript is

returned and the author advised of an appeal mechanism (usually through the appropriate line management to the MOU director).

1.3.10 Special Review Procedures

The review process described in the preceding sections applies to all manuscripts designed for issuance in the NBS technical publication series or to be published as official writing by NBS staff members in non-NBS publications. There are other NBS information products for which the review process is different.

(1) *Letters to Editor*

Letters to journal editors should be submitted to the ERB. A distinction is made between (a) a simple letter to the editor of a newspaper or a general publication, and (b) a more formal letter to the editor of a journal that has a special section bearing this title. The former is sent to ERB for a quick review to ensure that the letter is free of statements that are outside the jurisdiction of the Bureau or that could cause embarrassment to the Bureau. The latter is usually regarded as a short paper and must be accompanied by Form NBS-114 and Form NBS-114A. The ERB will normally expedite its handling.

(2) *Oral Presentations*

When a staff member plans to speak before an outside group, the ERB is notified by Form NBS-118 (Notice of Talk, exh. 1-E(h)) at least 10 days before the talk is given and 3 weeks if the talk is to be given outside of the Gaithersburg and Boulder areas. When possible, all talks are announced in the NBS *Technicalendar* 2 weeks in advance. The 2-week notification is particularly helpful to Department of Commerce field officers if the talk is likely to draw public or press interest (see sec. 5.2 for details about oral presentations).

(3) *NBS Audiovisual Programs, General Publications, and Articles for DIMENSIONS/NBS and Monthly Highlights*

If such programs and articles have direct public information implications, their review and production are coordinated by PID in Gaithersburg or by PIO in Boulder. All information prepared or coordinated by these offices undergoes stringent review before release (see secs. 1.7 and 5.5).

1.3.11 Manuscript Followup and Subsequent Changes in Papers for Non-NBS Media

It is important that the Bureau's publication records be complete and correct. Therefore, when a paper is published in an outside medium, two

¹In Boulder, use Form BL-7A (Boulder Review Form).

reprints or photocopies are forwarded to the Production Unit, TIPD, together with the completed Form NBS-266 (Notice of Publication in Non-NBS Media) and a completed Form NBS-114A (Bibliographic Data Sheet). The Form NBS-114A should reflect any changes subsequent to review and approval by ERB, but need not be retyped. In Boulder, reprints and forms are sent to PIO for recordkeeping in PIO and forwarding to TIPD. If the paper is part of conference proceedings, the full title, place, and dates of the conference are included.

After the Editorial Review Board (ERB) has released a manuscript, changes in the place of publication require concurrence of ERB. In addition, authors must report to ERB any subsequent changes in title or authors, withdrawal of a manuscript, or substantive changes in text.

If an editor of the outside publication declines to publish a manuscript, or if the author decides not to publish the paper after ERB approval, the ERB should be informed by a memorandum accompanied by any relevant correspondence.

For information about outside journals to which NBS is authorized to pay page charges for NBS-authored papers, see section 1.4.10.

1.3.12 Recognizing Outstanding Writing Achievements

(1) *Incentive Awards for Outstanding Written Exposition*

The Bureau encourages supervisors to use the incentive awards program as a mechanism for recognizing outstanding writing achievements of the staff. Scientific and technical papers and reports having high quality content and exemplary exposition should be noted. In the review and evaluation process, both ERB readers and sponsors are asked to recommend papers which should be considered for an award of merit. Such recommendations are referred to the author's supervisors by the ERB chairperson.

(2) *Condon Award*

A major Bureau award for notable accomplishment by the NBS staff is the Edward Uhler Condon Award. Its purpose is to recognize and to promote distinguished achievement in written exposition. Dr. Condon, for whom this award is named, was an outstanding Director of the Bureau from 1945 to 1951. He is also remembered for his distinguished authorship of numerous books, papers, and reports on a variety of subjects in science and technology.

To qualify for consideration for the Condon Award, a paper must have been recently published, usually within 1 year prior to nomination for the award. Papers by one or more authors are considered, and both a single paper and a series of

papers by an author or authors are eligible. Important characteristics of such papers are as follows:

- (a) Papers must have substantial scientific or technological merit and demonstrate clarity in style and effectiveness in exposition.
- (b) Papers must represent the contribution in style and content of the acknowledged authors except for minor editing changes that occur in the review process and in publication; therefore, papers by professional writers, whether acknowledged or not, will not be eligible for the award.
- (c) A *single* paper should be either a substantial review, a survey of a specific subject area, or a tutorial paper with a quality of exposition that appeals to a broad audience with a range of interests and specialties.
- (d) A *Series* of papers must demonstrate a sustained superior accomplishment by the same author or authors and need not be a review, a survey, or a tutorial series intended for broad audiences.

The Condon Award is presented at the NBS Annual Awards Ceremony along with other major NBS and Department of Commerce (DoC) awards. The award consists of an engraved plaque and an honorarium of \$3,000, which is shared equally if the paper has more than one author.

(3) *Nominating Authors*

In nominating authors of papers for either an incentive award or the Condon Award, supervisors should contact the incentive awards program officer of the Personnel Division to obtain forms and relevant submission instructions.

1.4 Legal Considerations

1.4.1 General Copyright Policy

Generally, official writings are in the public domain when they are performed as part of official duties; therefore copyright in the United States is not available.

This includes writings produced during working hours, using Government facilities. It also extends to writings devoted substantially to the responsibilities, programs, or operations of the Bureau or DoC, or to writings which draw substantially upon official data or ideas that have not yet become part of the body of public information (17 U.S.C. 8; 44 U.S.C. 58; "Writing for Outside Publication"—DoC Administrative Order 219-1). An exception is the Standard Reference Data Act (Public Law 90-396, 15 U.S.C. 290) which authorizes the Secretary of Commerce to secure copyright on behalf of the United States for standard reference data compiled and evaluated by NBS.

1.4.2 Submissions to Copyrighted Publications

When writings that fall under the preceding categories (except NSRDS items) are submitted to a non-NBS publication, a statement should be included indicating that the material is in the public domain and not subject to copyright. This caveat can be presented in a number of ways in these publications.

(1) Book chapters and articles of conference proceedings should have the following statement at the bottom of the first page of the section by an NBS author: "Official contribution of the National Bureau of Standards, not subject to copyright in the United States."

(2) Manuscripts submitted to non-NBS periodical publications should preferably have the following statement at the bottom of the first page of the article: "Contribution of the National Bureau of Standards, not subject to copyright in the United States." However, this statement may be shortened to "Contribution of the National Bureau of Standards" if the publisher prefers.

(3) The no-copyright notice may be omitted entirely from the NBS paper if the publication in which it appears carries a statement excluding U.S. Government material from its copyright coverage and the affiliation of the NBS author is clearly shown.

1.4.3 Manuscripts or Reports Prepared for NBS Under Contracts or Grants

In those instances where a manuscript has been prepared for NBS under a Government contract or grant, ownership of copyright will depend upon the copyright provisions in the contract or grant. When a report is the specific purpose of the work being performed, the NBS procurement contract will generally include the following no-copyright provision:

The contractor relinquishes any and all copyrights and/or privileges to the data developed under this contract, and such information will become the sole property of the Government. In addition, any data, in whole or in part, developed under this contract cannot be published by the contractor without the expressed permission of the Government; in the event permission is granted to publish any data, in whole or in part, the data shall be identified by such phrasing as: "This information is the result of tax-supported research. It may be reprinted without restriction with the customary crediting of the source."

When a contractor or grantee (including employees thereof), is permitted to assert copyright to materials produced under contract or grant, the copyright is subject to a nonexclusive, royalty-

free, irrevocable license for the Government to publish or reproduce the published form of the contribution, or allow others to do so for U.S. Government purposes (see sec. 3.5 for procedures for publishing these reports).

1.4.4 Using Excerpts from Copyrighted Material

The use of copyrighted material in NBS publications is also an important concern. NBS authors must recognize the need to obtain in advance the consent of the copyright holder before reprinting extensive sections. When authors plan to quote extensively or use any illustrations from copyrighted publications, they must obtain permission in writing from the copyright holder before the material may be used in any form of publication. In addition, the source and the copyright owner must be acknowledged either in the text or in a footnote. The following form is suggested:

Reprinted with permission from _____

Copyright 19__ by _____

Official writing by NBS authors and other employees in copyrighted books and periodicals may be reproduced in whole or in part without regard to an overall copyright of the publication in which the excerpt is found, provided that the source is explicitly acknowledged. However, when an NBS author plans to reprint such material by a non-NBS author, it is appropriate (as a matter of courtesy and as a means of ascertaining that the material is up-to-date and contains no copyrighted material) to inform the originating organization or author of the intent to use the material. One of the following statements may be appropriate:

Originally published in _____ or,

Reprinted from _____

A publisher's copyright notice should not appear on the original or reprint of official writings by Government employees.

1.4.5 Nonofficial Writing That May be Copyrighted

NBS staff members may write manuscripts that are not considered work of the U.S. Government, and for which a copyright may be claimed. If authors are unsure as to the status of their writing (official or nonofficial), they should check in Gaithersburg with the chief of TIPD and in Boulder with the chief of PIO. In general, it is recommended that authors request official approval from the Bureau's conflict-of-interest officer (Personnel Division) before undertaking nonofficial writing (see sec. 1.4.1 for definition of official writing).

1.4.6 Contributing Chapters to Technical Books

The Bureau has long recognized that the contribution of special subject matter chapters by NBS staff members to copyrighted non-NBS books often constitutes an appropriate and effective means of disseminating the results of the Bureau's research, development, and service activities to the scientific and technical community.

An increasing number of NBS staff members are receiving requests from technical book editors and publishers for book chapters, the preparation of which cannot be undertaken as nonofficial writing as defined in DoC Administrative Order 219-1, "Writing for Outside Publication." The reasons may be varied: the subject matter is inseparable from the author's NBS duties and responsibilities; the chapter would require the use of yet unpublished NBS data; or the contribution involves a deadline that would just not be realizable by the authors working on their own time and using only personal resources.

If an NBS staff member has been requested to write a book chapter and decides to prepare it on Bureau time, either entirely or partially, the author should take the following steps to avoid possible conflict of interest and to comply with Government policy:

- (1) Obtain written permission from the center/division director to prepare the chapter on Bureau time.
- (2) Conduct any necessary negotiations with the book editor or publisher, not by signing the usual formal contract, but through correspondence covering the following points:

- (a) The author is willing to prepare the article as a contribution of the National Bureau of Standards.
- (b) The following required notice is to be printed with the author's chapter: "Contribution of the National Bureau of Standards, not subject to copyright in the United States." This does not preclude the publisher from obtaining an overall copyright on the book itself.
- (c) Any honorarium or payment for the chapter that the author would normally be due should be made payable to NBS.

If appropriate, correspondence should also state the following:

- (a) The work is original except for material from acknowledged sources, and if any copyright material is used, permission has been, or will be, obtained for such use.
- (b) The publisher should provide NBS with a few complimentary copies of the published volume, and when feasible, some reprints of the NBS contribution.

1.4.7 Writing Separate Volumes or Books

The preceding procedures do not apply if a staff member has been requested to write or edit a separate volume or book by a commercial publisher on official time. It is *not* permissible to provide official writing services for a commercial or profit-making organization unless there is sufficiently strong justification to request the approval of the DoC and the Joint Committee on Printing.

Generally, an NBS staff member may write or edit a separate volume or book on official time for a professional society or nonprofit organization whose professional activities promote NBS objectives. The advance clearance procedures given for book chapters should be followed.

1.4.8 Honorariums and Royalties

In general, NBS authors are encouraged to accept an honorarium or royalty on behalf of NBS, if payment is offered for their official writings, i.e., in any of the following situations:

- (a) The writing has been done on Government time.
- (b) Significant contributions of substance or editing have been made by colleagues on Government time.
- (c) The manuscript has been prepared with use of Government facilities.
- (d) The writing is devoted substantially to the responsibilities, program, or operations of NBS or DoC.
- (e) The writing draws substantially upon official data or ideas which have not become a part of the body of public information.

Honorariums and royalties should not be waived, if any of the preceding apply. Instead the author should request that payment be made to the National Bureau of Standards, so that the payment can be deposited in the gift and honorarium fund created for that purpose.

An author may accept honorariums for nonofficial writings not covered by any of the restrictions listed in this section (see DoC Administrative Order 219-1 and sec. 1.4.4).

1.4.9 Use of NBS Name in Advertising

The longstanding policy of NBS is that its name or its materials cannot be used in any way, directly or indirectly, to imply approval or disapproval of a commercial product or process.

When communicating with commercial firms regarding calibration procedures for products (e.g., using measuring instruments) or for standardizing

material compositions marketed by such firms, the author should make clear the Bureau policy concerning advertising. For example, the statement "calibrated by the U.S. National Bureau of Standards" would almost certainly be misleading in an advertisement, since an NBS calibration applies only to a particular device at the time of its test. Moreover, statements containing phrases such as "approved by NBS" or "recommended by NBS" are precluded by DoC and NBS policy.

Precise statements of the actual relation of NBS-developed standards to a marketed item are allowed. Thus there is no objection to a statement by manufacturers that their primary standards have been periodically calibrated by NBS, if this is actually the case (see also Code of Federal Regulations, Title 15, sec. 200.113 or NBS SP 250).

1.4.10 Page Charges and Reprints

The Bureau is authorized by law to pay page charges and to purchase reprints of NBS papers in non-NBS publications. Certain requirements, however, must be met before page charges may be paid:

- (1) The journal must not be operated for profit.
- (2) Page charges must be levied impartially on all papers the journal publishes.
- (3) The journal must be published domestically.

Thus commercial and foreign journals do not qualify for payment of page charges, though the purchase of reprints is permissible.

To ensure that specific domestic journals qualify for page charges and that the NBS paper has been reviewed and released by an ERB, the person making the request routes the purchase request (Form NBS-10A) for payment of page charges and purchase of reprints through TIPD in Gaithersburg, or through PIO in Boulder. This procedure also enables NBS to keep central records of such requests.

Both page charges and reprint orders are charged to the appropriate division project. The page charges and reprinting costs are shown as separate items on the purchase request. When the journal's page charge/reprint order form is returned to the publisher with the galley proof, the publisher's order form should bear the notation: "Formal NBS purchase order will follow," as only the Bureau's contracting officer can legally commit payment. A copy of the publisher's order form is retained and attached to Form NBS-10A.

Reprints are the property of the Bureau. If authors leave the Bureau, they may take a supply of reprints, provided sufficient stock remains at NBS to meet future anticipated needs.

1.4.11 Avoiding the Use of Trade Names

The Joint Committee on Printing, DoC, and Bureau policies require that NBS authors avoid the use of trade names in all manuscripts (including illustrations) except where public safety or health is involved or where mention of the trade name is *essential* to comprehension of reported results and would not result in a competitive advantage or disadvantage to a manufacturer. In general, authors should use generic terminology rather than specific commercial identification.

Even when trade names are avoided, the Bureau may be required to reveal the identity of commercial products used in NBS investigations if a formal request is made under the Freedom of Information Act. This possibly should be kept in mind when reports are written, reviewed, and approved. See section 1.5.3(2)(b) for guidance on handling public requests for reports containing sensitive and trade name information.

1.4.12 When Trade Names May Be Allowed

When a trade name is required for a clear understanding of the paper, an author must use care to prevent possible misuse of the passage by others, or objection by the manufacturers or distributors of the same or competitive products. Mention of the trade name in a footnote, rather than in the body of the text, may help prevent its misuse.

Situations that may require trade name or other specific identification of commercial products (e.g., materials, equipment, or instruments) in NBS manuscripts usually fall into one of the two following categories:

- (1) Precise identification of the product is necessary to specify adequately the experimental procedure used to determine some physical or chemical property of some *other* material or system.
- (2) Precise identification of the product is necessary because the product is part of an assembly or machine and is a part whose physical dimensions or technical characteristics must, in the event of damage or failure, be duplicated exactly in a successful replacement part.

If modifications of a system or equipment have been made to provide some additional features, these changes are also described in sufficient detail to permit duplication. In the case of materials, the information given should be adequate to characterize the materials.

In situation (1) the manuscript ordinarily includes, as a footnote to the first identification of the product, or to the section containing it, an appropriately worded disclaimer. The following is an example: "Certain commercial equipment, instruments, or materials are identified in this paper in

order to adequately specify the experimental procedure. Such identification does not imply recommendation or endorsement by the National Bureau of Standards, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose."

Occasionally it may be permissible to omit this footnote when only isolated passing reference is made to a well-recognized product. Even when a disclaimer is used, mention of trade names are kept to a minimum.

In situation (2) use of a trade name is permitted so as to enable others to reproduce the reported results in their laboratories. Details of procedures, methods, and equipment are included to the extent necessary for this purpose. For example, in many cases identification of a material as "Teflon" may be sufficient; in other cases it may be necessary to identify it as "Teflon 5" or "Teflon 7." Generally, in the case of instruments, precise identification may require giving both the manufacturer's identity and the model number.

Specific clearance must be obtained from the appropriate MOU director for reports which involve the performance of brand name products, instruments, or commercial organizations. If a center director makes a determination that the item or organization must be identified in the report, the rationale and justification must be set forth in a memorandum to the MOU director, as soon as possible and preferably prior to acceptance of the work, requesting approval to issue such a report. The MOU director, prior to taking action on the request, may consult with the legal advisor if, in the director's judgment, it is necessary to ensure that all legal implications are considered. If the MOU director approves the use of specific names in the report, the director should sign Form NBS-114 prior to the manuscript's transmission to the ERB, and if the MOU director considers it desirable, should request that the final report be subject to a legal review as well as technical review.

1.5 Reports to Sponsors

1.5.1 Quality Control

NBS reports of work sponsored by other agencies, regardless of the form they take, are subject to quality control requirements, as are all other technical reports of NBS. This normally includes the review and approval procedures given in section 1.3, including clearance by the appropriate ERB. Even when urgent deadlines must be met, special arrangements can usually be made for full review by ERB. However, if time constraints make ERB review impracticable, special procedures established by the MOU directors shall be followed.

In such a case, a copy of the report must be sent to the appropriate ERB for post technical and policy review, and for recordkeeping.

The center director (or delegate) is responsible for identifying any reports for which review by the NBS legal advisor is necessary. ERB may also decide to request legal review for certain reports.

For guidance on the use of trade names in reports to sponsors, see sections 1.4.11 and 1.4.12.

1.5.2 Negotiations with Sponsors²

The agreement between NBS and a sponsoring agency should contain an explicit statement of the procedures for reporting. The following matters should be clearly specified in the agreement:

- (1) Dates and formats of progress reports, if any;
- (2) Dates and formats of topical and final reports;
- (3) Number of copies to be provided to sponsor;
- (4) Extent and method of distribution of report by both sponsor and NBS; and
- (5) Responsibility for release of information to the public. Unless the report is a memorandum or letter, NBS will normally release it to the National Technical Information Service (NTIS), although in special circumstances it may be withheld by joint agreement of NBS and the sponsor.

1.5.3 Types of Reports to Other Agencies

Work reported to external sponsors will generally take one of three forms: an NBS publication, an NBS Interagency/Internal Report (unless the sponsoring agency requires that its own format and issue procedures be followed), or an NBS-Sponsor Communication.

(1) NBS Publications

In this form, the report of sponsored work appears in one of the GPO-printed series, such as the Technical Note, Building Science Series, or Special Publication.

NBS GPO-printed publications receive wide distribution, both inside and outside the Government. Both NBS and the Superintendent of Documents, who handles public sales, give these publications wide promotion and publicity and ensure that they are abstracted and indexed by major bibliographic services. NTIS cites them in its announcement journals and sells them in microfiche or paper copy form. Publication in these series avoids the added

²See NBS Policy Bulletins 5, 6, and 7 and Administrative Manual Chapter 11, Subchapter 4 for policy guidance for accepting other-Agency work and negotiating agreements.

costs that result when material initially published in limited-availability versions is subsequently republished for wider distribution (see ch. 3 for more information about these series).

(2) NBS Interagency/Internal Reports (NBSIRs)

This method of reporting results to sponsors should be used when an NBS GPO-printed publication is not acceptable to the sponsor, when the information reported is a preliminary progress report or material not appropriate for wider distribution, or when time constraints make it impractical to prepare and publish the results through the GPO.

In the latter case, if the material is otherwise appropriate for wider distribution, it should be considered for publication in a different form. When the material will be published in a second form, the NBSIR should indicate on the title page that an NBS publication is forthcoming and the Bibliographic Data Sheet (Form NBS-114A) of the NBSIR should indicate "limited" distribution (see (a) below).

NBSIR publications have the following characteristics:

(a) Primary (initial) distribution is limited to those persons who have a definite interest in the subject. The distribution is determined by the sponsor and NBS jointly, and carried out by either agency. By mutual agreement, secondary distribution is accomplished by sending the reports to NTIS for public announcement and sale. In some instances, NBS and the sponsor may agree on a restricted distribution because the report contains proprietary information, preliminary and fragmentary results, or policy recommendations for further consideration by the sponsor. If so, the appropriate block in item 13 of Form NBS-114A (Bibliographic Data Sheet) should be checked. (This block reads: "For Official Distribution. Do not Release to NTIS.") The reason for restricting distribution may be further explained in a "special notice" on the inside front cover, the text for which may be provided by the sponsor or NBS (see sec. 1.5.4).

(b) Limited or restricted NBSIRs must be made available to all interested parties upon request under provisions of the Freedom of Information Act unless the documents fall within one of the exemptions clearly specified in that act. The possibility of distribution to the general public should be kept in mind when such reports are written, reviewed, and approved. Freedom of Information inquiries and other public requests for the release of limited or restricted reports containing sensitive matters and trade name identification should be directed to the legal office for coordination with the appropriate ERB and MOU. This also applies to requests for the trade name identification key for both restricted and

unlimited reports in which trade products or commercial organizations are coded.

(c) As with other publications, the use of trade names should be avoided, except as prescribed in section 1.4.12.

(d) Reproduction is handled by the Printing and Duplicating Unit in Gaithersburg (PIO in Boulder). The time between submission and reproduction is 2 to 3 weeks (see sec. 3.2 for more information about NBSIRs. See sec. 4.4 and exhs. 4B, 4C, and 4D for guidelines for preparing NBSIR copy).

(3) NBS-Sponsor Communications

The term "NBS-Sponsor Communication" means a letter or memorandum to an appropriate person in the sponsoring agency. Because of the urgency or nature of such communications, a central review by the ERB is not required. Full accountability and recordkeeping rests with the originating organization under procedures established by the MOU director.

NBS-Sponsor Communications have at least one of the following characteristics:

- (a) The urgency of the report is such that only this format can meet the sponsor's needs.
- (b) The material is of interest only to the project monitor and a small number of associates.
- (c) The material contains proprietary or otherwise administratively restricted information. Typical examples might be results of product safety tests for the Food and Drug Administration, or codes identifying samples of commercial products used in performance tests for the General Services Administration.

Regardless of limitations on initial distribution, such communications may be subject to release under the Freedom of Information Act if they contain technical data and other factual information.

1.5.4 Restrictive or Superseding Notices

No restrictive or superseding notice of any kind is needed for reports to sponsors except under the following circumstances:

- (1) If the report to the sponsor is to be republished in another NBS publication series, the title page should bear the following legend: "This report is to be superseded by a future publication which will receive general distribution. Please consult the NBS Technical Information and Publications Division to obtain the proper citation."
- (2) Progress reports or preliminary reports should contain an appropriate notice of limited value. One of the following may be used:

(a) "This is a progress report. The work is incomplete and is continuing. Results and conclusions are not necessarily those that will be included in the final report."

(b) "This report presents results of a preliminary study. A number of uncertainties remain that should be considered in more detail. Therefore, the conclusions are not necessarily those that would be reached in a full and complete investigation."

(3) Reports containing sensitive matters that may involve NBS in litigation or may raise controversial issues of concern to high Administration officials or the Congress should receive limited distribution and carry a notice of the following type:

"This document has been prepared for the use of (identification of sponsoring agency). Responsibility for its further use rests with that agency. NBS requests that if release to the public is contemplated, such action be taken only after consultation with the Technical Information and Publications Division at the National Bureau of Standards."

When notified by sponsors of their intention to release such a report, TIPD will immediately bring the matter to the attention of the originating unit and the appropriate ERB (see also sec. 1.4.12).

1.6 General Inquiries

An important part of the information program is the numerous direct contacts by NBS technical staff with their peers in academia, industry, and other research laboratories. (For information on handling media inquiries, see sec. 1.7 and ch. 5.) Supplementing this effort are the specialized services of the NBS information analysis centers of the National Standards Reference Data System, numerous NBS special subject information offices (as listed by the Library of Congress National Referral Center), the information services of the Library Division, and the inquiry service of TIPD in Gaithersburg and PIO in Boulder.

In Gaithersburg, TIPD responds to or refers to appropriate staff members approximately 65,000 letters and telephone inquiries annually, and PIO in Boulder handles about 5,000 each year.

1.6.1 Responsibilities of Staff Members

Responding to inquiries is, of course, an important public service, and the NBS staff members involved are responsible for making this correspondence program an effective one. Aids to such correspondence are available in the form of brochures, press releases, letter circulars, lists of

publications, and, when justified, the technical publications of the Bureau. A list of some of the current aids to correspondence is given in exhibit 1-F.

1.6.2 Letter Circulars

As aids to quicker and more economical handling of recurring requests for the same information, a number of letter circulars (LCs) have been prepared by various Bureau laboratories. Letter circulars usually present general information and are made available only when no other publication can satisfy frequent requests from the public for the information.

Letter circulars receive careful editorial review by the originating units and the appropriate ERB.

1.6.3 Lists of Publications

Lists of publications (LPs), like letter circulars, are also aids to correspondence. There are three types of lists of publications: (1) references to published works by staff members of a specific NBS laboratory or office, (2) references on a given subject by NBS staff members, and (3) references on a given subject, including work by NBS staff members and by outside authors. Lists of type (3) are sometimes expanded and submitted as formal Bureau publications.

Lists of publications receive careful editorial review by the originating units and the appropriate ERB.

1.7 Media Liaison

Representatives of the news media are given special attention by the Bureau in order to foster accurate and influential exposure for NBS activities and to assure that NBS research results are communicated to various public and professional audiences via the press. In Gaithersburg, media liaison is provided by PID, which assists staff members in initiating and responding to news media contacts; in Boulder, PIO performs this function. These offices have public information specialists who cover assigned areas of Bureau work and assist staff members in preparing and clearing material for the technical, trade, and general news media—including magazines, newsletters, newspapers, and radio and television stations. Generally excluded from the responsibilities of the media liaison group is the scientific or archival literature that appears in technical journals for scientific and peer audiences.

Written materials prepared by public information specialists include news releases, fact sheets, press advisories, newsletters, brief consumer-oriented reports, articles for DIMENSIONS/NBS and the

NBS Standard, and publication announcements. The media liaison group also arranges articles by and interviews with Bureau staff as requested by the media. Other responsibilities include: arrangements for news conferences and preparation of materials specifically for radio and television when appropriate; daily monitoring of media coverage of NBS activities; and weekly reporting to the Secretary of Commerce on major accomplishments and activities at NBS.

Clearance for written materials produced by the media liaison group involves thorough review for technical accuracy and policy, usually at least through the MOU directors level and, when appropriate, through the Office of the Director, the Department, and non-NBS agencies and organizations (see exh. 1-E(g) for PID clearance Form NBS-50 and Media Distribution List).

Staff members should contact the appropriate media liaison group in PID or PIO under the following circumstances:

- (1) When contacted for information by a representative of the news media they don't know personally;
- (2) When they have produced results that could be of interest to the news media;
- (3) When they wish to release any information concerning NBS to the news media either through NBS or through another organization.
- (4) When they feel that their statements, NBS policy, or NBS research results have been misrepresented in an article in the news media; and
- (5) When they have provided information to media contacts with whom they have established a good working relationship.

In the case of (5) the appropriate media liaison group should be contacted, within 1 working day after the response has been made.

Exhibit 1-A. Charter National Bureau of Standards Editorial Review

The NBS editorial review boards at the Gaithersburg and Boulder sites have been established as standing committees by the Director, NBS, to assist the staff and management to maintain the highest possible quality of content and style of NBS publications. The Director holds the heads of the major operating units responsible for the quality of the work done in their organizations and for its reporting. The Bureau-wide editorial review boards are a part of the process of technical, policy, and editorial review employed by management to help ensure the quality of NBS reporting.

Membership of the Boards:

A. Washington Editorial Review Board (WERB)

- The Washington Editorial Review Board shall consist of the Chairperson, one representative of each center of each major operating unit, and up to three "at large" members to ensure that necessary competences are available to facilitate the work of the Board (e.g., statistical analysis).
- The Chairperson of the Board is appointed by the Director, and is expected to have a broad knowledge of the Bureau's mission and goals, its technical programs, and the channels of communication used to distribute the Bureau's output.
- Each Center Director, shall designate a representative, who shall be appointed a member of WERB by the Chairperson. The Chairperson may appoint up to three additional members to obtain necessary expertise.

- Each member shall serve for 2 years and may be reappointed by mutual consent. Terms shall be staggered to assure maximum continuity and shall begin at the beginning of each fiscal year. Half of the initial appointments, beginning in FY 1979, shall be for a period of 3 years to obtain the desired staggering.
- The Chief, Technical Information and Publications Division, shall serve as an ex-officio member of WERB, and a member of the TIPD staff shall serve as Executive Secretary.

B. Boulder Editorial Review Board (BERB)

- The Boulder Editorial Review Board shall consist of one representative of each division, plus up to two additional members to ensure that needed competences are available.
- Each Center Director to whom the Boulder divisions report shall designate a representative of each division, who shall be appointed BERB members by the Director, NBS Boulder Laboratories.
- The Chairperson, BERB, will be appointed by the Director of the Boulder Laboratories with the concurrence of the Directors of NML and NEL.
- Each member of BERB shall serve for 2 years and may be reappointed by mutual consent. Terms shall be staggered to assure continuity.
- The Chief, Program Information Office, will serve as an ex-officio member.

C. JILA Editorial Review Board (JERB)

- The Editorial Review Board of the Joint Institute for Laboratory Astrophysics (JILA) shall consist of the Chief of the Quantum Physics Division plus three additional persons, all of whom may be, but do not necessarily have to be, NBS employees assigned to JILA. One or two may be on the staff of the University of Colorado.
- The Chairperson and members of JERB are appointed by the Chief of the Quantum Physics Division with the concurrence of the Director of the Center for Absolute Physical Quantities and the Director of the Boulder Laboratories.
- Each member of JERB shall serve for 2 years and may be reappointed by mutual consent. Terms shall be staggered to assure continuity.

Functions of the Editorial Review Boards:

- The editorial review boards shall conduct technical, policy, and editorial review of all technical manuscripts and letters to the editor for which at least one NBS person is an author, if the work is considered to be "official writing." In special circumstances, other manuscripts may also be reviewed (e.g., those reporting on work done under contract to NBS). If, in the judgment of the board, legal review is also needed, the board will request such review from the office of the NBS Legal Adviser.

• With appropriate consultation with designated representatives of the MOU offices, the editorial review boards shall develop procedures for review of the Bureau's technical output.

• Policy issues which arise within the activities of the editorial review boards shall be resolved by the Chairperson of the Washington Editorial Review Board, who will seek guidance from the Director, if existing policy guidelines are not adequate.

• The editorial review boards shall review papers nominated for the E. U. Condon Award for Distinguished Writing and submit recommendations on the winner for consideration by the Director.

• The review boards shall review and note notices and abstracts of talks, and other technical information outputs of NBS to assure technical accuracy and adherence to NBS policies.

• Papers, reports, and other technical writings which have satisfactorily passed the review procedures established by the editorial review boards shall be released by the Chairperson of the appropriate board for publication or for the intended distribution outside NBS.

• Information releases and responses to the media and the general public are the responsibility of the Public Information Division, operating under different review and approval procedures.

Approved March 12, 1979



Exhibit 1-B. Bureau-Wide Advisory Boards for Periodicals

1. Board of Editors for *Journal of Research of the National Bureau of Standards*—Established April 1977 to oversee and direct the selection and acquisition of articles for the *Journal of Research of the National Bureau of Standards*, and to provide guidance to authors with respect to content and form.¹

2. *DIMENSIONS/NBS*—Advisory Board—Established to guide the staff of *DIMENSIONS* in coverage of Bureau activities and selection of technical staff members to write feature articles and editorials.¹

3. *NBS Standard* Advisory Committee—Established in the 1960's to provide policy guidance for

the editor of the *Standard* and regular review and evaluation of the newsletter.¹

4. The Board of Editors of the *Journal of Physical and Chemical Reference Data* shall consist of: (a) an Editor-in-Chief appointed by NBS; (b) three board members appointed by AIP; (c) three board members appointed by ACS; and (d) three board members appointed by NBS. The Board of Editors of the *Journal* shall meet at least once each year. It shall advise the Editor-in-Chief on matters of editorial policy and may be called upon to assist in reviewing manuscripts.

¹ Charters for these periodicals appear in the NBS Administrative Manual, 3.01 Appendix A.

Exhibit 1-C. The Path to Publication for Scientific and Technical Papers—Gaithersburg

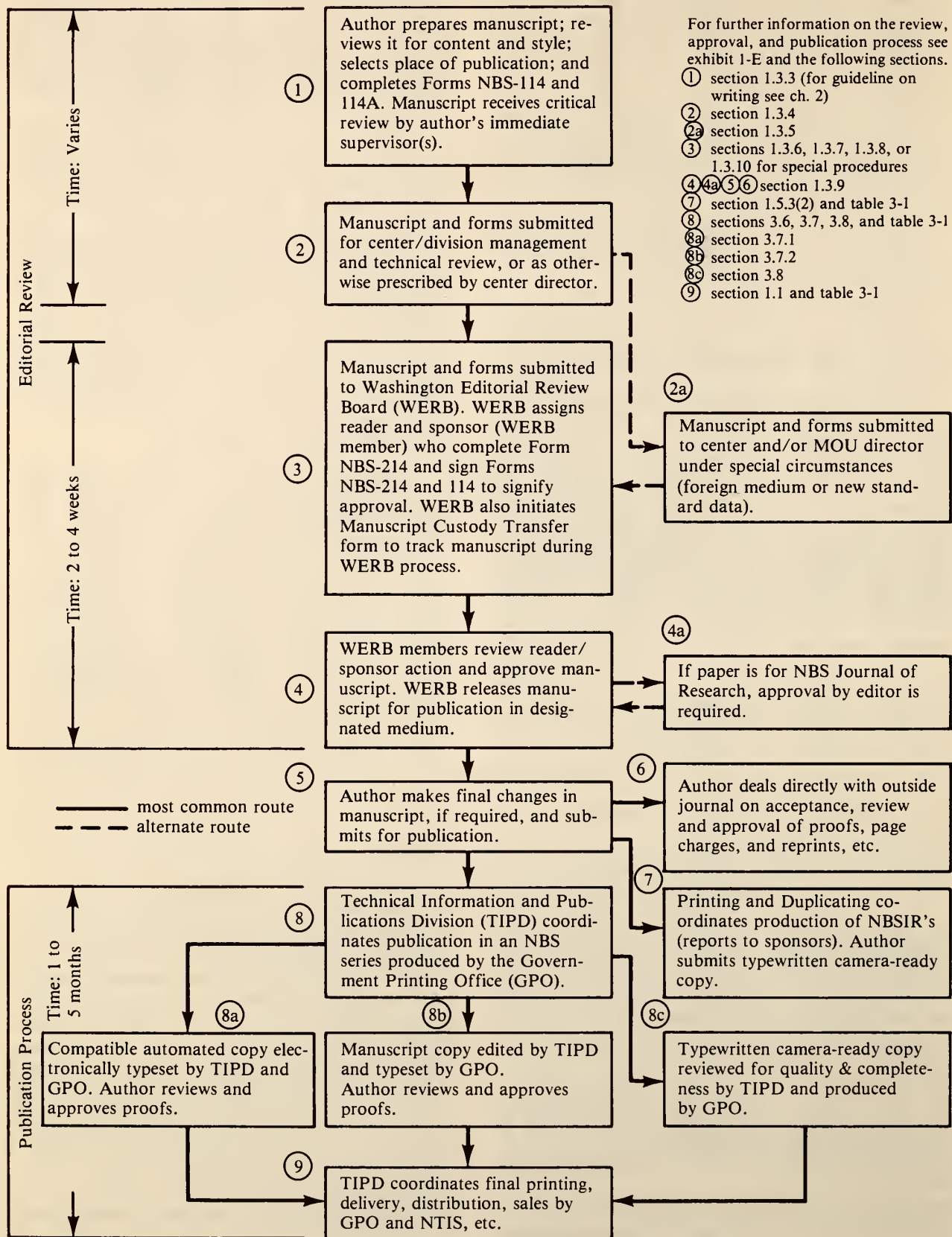


Exhibit 1-D. The Path to Publication for Scientific and Technical Papers—Boulder

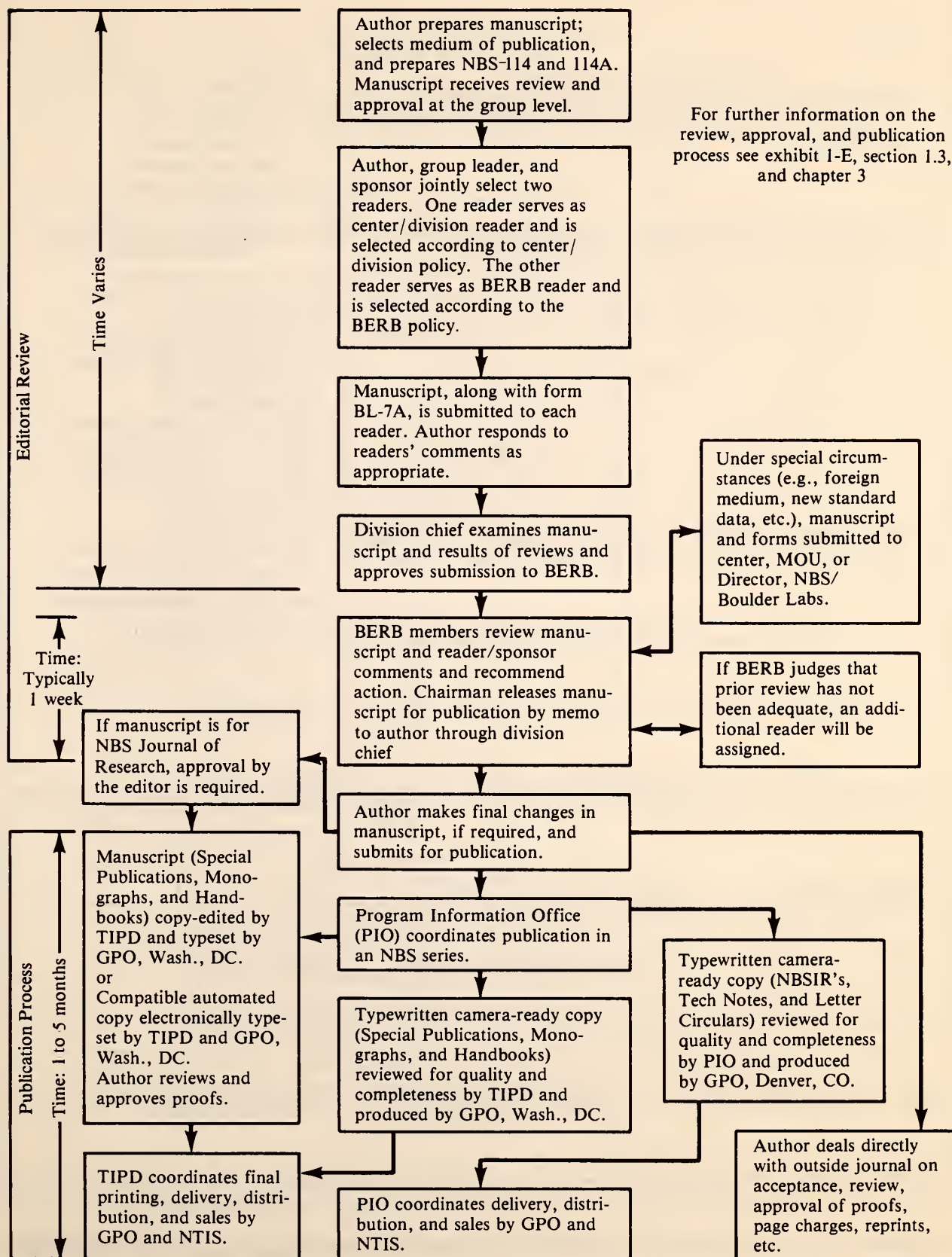


Exhibit 1-E(a). Manuscript Review and Approval, Form NBS-114

NBS-114 (REV. 2-80)		U.S. DEPARTMENT OF COMMERCE NATIONAL BUREAU OF STANDARDS																			
MANUSCRIPT REVIEW AND APPROVAL																					
INSTRUCTIONS: Attach original and 1 copy (photocopy) of this form to one copy of manuscript and send to: The Secretary, appropriate Editorial Review Board. <u>Complete form per instructions on reverse side.</u>																					
1. TITLE OF PAPER:																					
2. Author(s), include title and affiliation. If NBS, give Organizational Code No. and Tele. Ext.	Signature (of submitting NBS author; see instruction 2)	Date																			
7. APPROVAL (Per instruction 7; type or print name)	Signature	Date																			
Division/Office Chief																					
Division/Center Reader																					
Center Director																					
8. MOU Director Approval (If required. See instruction 8)		Date																			
10. EDITORIAL BOARD		9. ERB MANUSCRIPT CUSTODY TRANSFER (see reverse)																			
Reader	Signature	Date	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;">Date</th> <th style="width: 25%;">From</th> <th style="width: 25%;">To</th> </tr> </thead> <tbody> <tr><td style="height: 20px;"></td><td></td><td></td></tr> <tr><td style="height: 20px;"></td><td></td><td></td></tr> <tr><td style="height: 20px;"></td><td></td><td></td></tr> <tr><td style="height: 20px;"></td><td></td><td></td></tr> <tr><td style="height: 20px;"></td><td></td><td></td></tr> </tbody> </table>	Date	From	To															
Date	From	To																			
11. EDITORIAL BOARD MEMBERS	12. J. RES., JPCRD, or NBS-NSRDS EDITOR APPROVAL (Signature and date)		13. RELEASED FOR PUBLICATION (Signature of authorized official and date)																		

Note: Forms 114, 114A, and 214 are used by Gaithersburg staff; Forms 114, 114A, and BL-7A (see ex. 1-E(d)) by Boulder staff.

INSTRUCTIONS FOR COMPLETING FORMS

FORM NBS-114: MANUSCRIPT REVIEW AND APPROVAL

1. Give the title in full as it is to appear when the paper is published.
2. List all authors in the order in which they are to appear in the published paper. Only one signature of an NBS author is required, but the signing author thereby acknowledges that manuscript approval has been obtained from the other listed authors.
3. Leave blank. This will be filled in by the Technical Information and Publications Division.
4. This information is helpful in processing the manuscript and in assuring that no parts of it are inadvertently omitted (manuscripts in automated form may be converted to typeset copy if desired).
5. This space is to remind the author(s) and their supervisors to make a conscious decision on the desirability of filing a patent application. NBS staff members are encouraged to seek patent coverage of appropriate new developments.
6. Select the appropriate publication medium after careful consideration of the desired audience (see NBS Communications Manual for guidance).
7. At least one management signature and at least one technical review signature at the Center or Division level are needed. Editorial procedures for achieving this requirement are determined by the Center Director consistent with MOU policies. In addition, the Center Director's (or the NBS Boulder Director's) signature is required for publication in a foreign medium.
8. The MOU Director's signature is needed only for papers that report new values of, or methods for determination of basic physical standards or fundamental constants, or that report material likely to draw conspicuous public attention to NBS.
9. Manuscript custody, or tracking record, reflects routing and dates during the editorial review process after submission to the appropriate ERB.
- 10, 11. For ERB use. ERB normally assigns one reader and one sponsor (ERB member) to each paper. After review, papers are returned to ERB for final review and approval by members.
12. This space is for approval by an editor of certain NBS publications. These publications are the NBS Journal of Research, JPCRD, and the NBS-NSRDS series.
13. Authority to release papers for publication has been delegated by the Director to the Chairperson of the appropriate ERB. If ERB is unable to approve the paper for publication, the author will be advised of an appeal mechanism.

FORM NBS-114A: BIBLIOGRAPHIC DATA SHEET. This bibliographic data sheet meets the standards adopted for use by all U.S. Government agencies. It is needed for NTIS processing and must accompany all NBS papers, those appearing in nongovernmental media as well as those in NBS series, since all reports of NBS technical work are normally entered into the NTIS system. For all GPO publications, it becomes an integral part of the document and is widely used by librarians and abstractors.

- Items 1, 2** — Complete if information is available; otherwise Publications Office will complete later. If non-NBS publication, state "see item 10" (enter other agency sponsor's report number if requested to do so, and enter NBSIR number under item 2).
- Item 3** — Complete if known; otherwise Publications Office will complete.
- Items 4, 5** — Complete as shown on manuscript. When NBS-114A is resubmitted along with NBS-266, following publication of non-NBS media papers, these items must agree with published paper.
- Item 6** — If not NBS, blank out and enter Grantee/Contractor name and address, or if performed jointly, show both.
- Item 7** — Complete when applicable.
- Item 8** — Enter "Interim", "Final", or period covered.
- Item 9** — Enter all sponsors' names and addresses. Include NBS if also a sponsor.
- Item 10** — Enter other relevant information, i.e., related or superseded documents. Also used by Publications Office for Library of Congress catalog number, and entry of non-NBS media citation upon receipt of Form NBS-266 from author. Check block if appropriate and attach SF 185.
- Items 11, 12** — Prepare abstract and key words with special care. These are published separately by NBS, NTIS, and other bibliographic services, and are vital elements in guiding readers to your paper. The key words will be used as entries in a subject index (see NBS Communications Manual for additional guidance).
- Item 13** — Indicate "Unlimited" — for open-literature documents cleared under NBS editorial procedures, or "For official distribution. Do not release to NTIS." — for limited, restricted, or need-to-know material (see NBS Communications Manual). Publications Office will mark appropriate "order" box and complete Stock Number when known.
- Items 14, 15** — Leave blank. To be completed by Publications Office or Printing and Duplicating for NBSIR's.

Exhibit 1-E(b). Bibliographic Data Sheet, Form NBS-114A
(see instructions on previous page)

NBS-114A (REV. 2-80)

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET (See instructions)		1. PUBLICATION OR REPORT NO.	2. Performing Organ. Report No.	3. Publication Date
4. TITLE AND SUBTITLE				
5. AUTHOR(S)				
6. PERFORMING ORGANIZATION (If joint or other than NBS, see instructions) NATIONAL BUREAU OF STANDARDS DEPARTMENT OF COMMERCE WASHINGTON, D.C. 20234			7. Contract/Grant No.	8. Type of Report & Period Covered
9. SPONSORING ORGANIZATION NAME AND COMPLETE ADDRESS (Street, City, State, ZIP)				
10. SUPPLEMENTARY NOTES				
<input type="checkbox"/> Document describes a computer program; SF-185, FIPS Software Summary, is attached.				
11. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here)				
12. KEY WORDS (Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons)				
13. AVAILABILITY			14. NO. OF PRINTED PAGES	
<input type="checkbox"/> Unlimited <input type="checkbox"/> For Official Distribution. Do Not Release to NTIS <input type="checkbox"/> Order From Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. <input type="checkbox"/> Order From National Technical Information Service (NTIS), Springfield, VA. 22161			15. Price	

USCOMM-DC 8043-P80

Exhibit 1-E(c). Manuscript Evaluation, Gaithersburg Only, Form NBS-214

NBS-214 (REV. 9-78)		U.S. DEPARTMENT OF COMMERCE NATIONAL BUREAU OF STANDARDS		ERB CONTROL NO.	
MANUSCRIPT EVALUATION NBS Editorial Review Board (ERB) (Optional for Division/Center Use)				From:	
To: <i>(Reader's name and address)</i>		Date		Return To: <i>(Sponsor's name and address)</i>	
<p>Please review the attached manuscript for technical content and quality of expression. In addition, statements interpreted to be in conflict with established NBS policies should be noted. You are urged to discuss suggestions for revisions directly with the author. You may wish, however, to remain anonymous. If so, you may discuss the manuscript with the Secretary of ERB, or with the sponsor of the paper, or return it with your written comments. Please complete your review promptly and return the form and attachments within two weeks or sooner, if possible. Your assistance is much appreciated by the Editorial Review Board and the NBS managers who are held responsible for the quality of publication.</p>					
READER'S CHECKLIST: The following items are listed to assist you in reviewing the attached manuscript.					
1. General Value: Clear statement of the problem, the methodology, the analysis, and the conclusions. 2. Manner of Presentation: Informative title, statements of accuracy and precision adequately expressed, concise captions for tables and figures, sufficient literature citations, and appropriate quantities and values expressed in SI units. 3. Abstract and Key Words: Abstract should be succinct statement of the purpose and conclusions of the paper and be informative enough to be published independent of the paper. Key words or phrases should be suitable for subject indexing. 4. NBS Policy: Should not be in conflict with current NBS policy. 5. Proposed place of publication appropriate. 6. See NBS Communications Manual for more detailed guidance.			I recommend the following action for this manuscript: <input type="checkbox"/> Approve <input type="checkbox"/> Approve: Suggested changes to be considered by the author(s) <input type="checkbox"/> Approve: Changes have been agreed to by the author(s) <input type="checkbox"/> Approve only if specified changes are made <input type="checkbox"/> Refer to another reader <input type="checkbox"/> Do not approve <i>(Please comment below)</i> <input type="checkbox"/> Recommend for an award. The paper is found to be (Good – excellent – worthy of distinction) for (Technical content – quality of exposition – both) (Please circle appropriately and comment below)		
Comments: <i>(With attachments if necessary)</i>					
Reader <i>(Signature here and on NBS-114)</i>				Date	
SPONSOR'S COMMENTS: I recommend the following action(s) for this manuscript <input type="checkbox"/> Approve <input type="checkbox"/> Recommend that it be considered for an award <input type="checkbox"/> Refer to another reader <input type="checkbox"/> Do not approve for the following reasons: <i>(Comments with attachments if necessary)</i>					
Sponsor <i>(Signature here and on NBS-114)</i>				Date	

Exhibit 1-E(d). Boulder Editorial Review Form, Form BL-7A

Form BL-7A (Rev 11/79)	<h1 style="margin: 0;">NBS Boulder Editorial Review Form</h1>	U. S. Department of Commerce National Bureau of Standards Boulder, Colorado 80303 (303) 499-1000
BERB Control No: 		

SECTION I: (To be completed before submitting for review)

Manuscript Title			
Author's Name(s)	Div. or Affiliation	Room	Extension
BERB Sponsor's Name		Room	Extension
Intended Medium of Publication			
Name and Affiliation of Reviewer			
This review is for <input type="checkbox"/> the Division <input type="checkbox"/> Editorial Review Board			

SECTION II: Instructions to Reviewer

Please answer all questions in SECTIONS III and IV by marking the appropriate boxes and adding comments as needed. Additional comments may be written on the manuscript or on a separate sheet. If you wish you may discuss the review with the author. This completed form, along with the manuscript, should be returned to the Sponsor by _____, 19___. If the review will take longer, please notify the sponsor or author immediately.

Thank you for your cooperation and willingness to serve as a reviewer.

SECTION III:

1. Judge the significance of this work.

Major Significance Significant Minor Significance

Explanation:

☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1

2. Judge the interest that this paper will arouse in the technical community.

General

Special

Explanation:

☐ 5 ☐ 4 ☐ 3 ☐ 2 ☐ 1

3. Is the proposed medium of publication appropriate?

☐ Yes

☐ Another preferred

☐ No

Explanation:

4. Is the paper technically sound and reliable?

☐ Yes

☐ Minor deficiencies

☐ Major deficiencies

☐ Can't determine

Explanation:

5. Is the relationship to other work given so that the author's contribution may be seen in proper perspective?

☐ Yes

☐ Improvement Suggested

☐ No

Explanation:

Exhibit 1-E(d). Boulder Editorial Review Form, Form BL-7A—Continued**SECTION III (Cont.)****6. Judge the quality of presentation.**

(Examples: Is it well organized, clear, and self-contained?

Is it free from specialized jargon? Are conclusions clearly stated?)

Explanation:**Outstanding****Satisfactory****Inadequate**☐ 5☐ 4☐ 3☐ 2☐ 1**7. Are the title and abstract clear, concise, and complete?****Explanation:**☐ Yes☐ Improvements Suggested☐ No**8. Is the preparation of the manuscript adequate?**

(including figures, tables, captions, references)

Explanation:☐ Yes☐ Improvements Suggested☐ No**9. Are there any controversial aspects to this manuscript that should be carefully considered before publication?****Explanation:**☐ Yes☐ Possibly☐ No

SECTION III (Cont.)

10. Recommendation

- ☐ Publication in present form in proposed medium (changes at the discretion of the author)
- ☐ Publication with ☐ indicated revisions ☐ change in medium
- ☐ Revision and further review
- ☐ Rejection

Additional comments:

SECTION IV:

1. What is your degree of familiarity with the subject?

Expert

Knowledgeable

Uninformed

☐ 5☐ 4☐ 3☐ 2☐ 1

2. Are there any aspects of this manuscript that you were unable to review adequately?

☐ Yes☐ No

Specify:

3. Have you discussed this review with the author?

☐ Yes☐ No

Comments:

Signature of Reviewer

Date

Exhibit 1-E(e). Publications Followup Office Record, Form NBS-265

NBS-265 (Rev. 8-72)		U. S. DEPARTMENT OF COMMERCE NATIONAL BUREAU OF STANDARDS		AUTHOR(S)	
PUBLICATIONS FOLLOW-UP OFFICE RECORD <i>(Read Instructions below before completing this form)</i>					
TITLE OF MANUSCRIPT				COST CENTER	
TO BE PUBLISHED IN (NBS PUBLICATION OR OUTSIDE JOURNAL)				PUBLICATION REFERENCE	
				JOURNAL OR NBS PUBLICATION	
FOLLOW UP DATES				VOL.	NO
				PAGES	DATE
ALL PUBLICATIONS		OUTSIDE PUBLICATIONS		REPRINT INFORMATION	
TO DIVISION OFFICE OR DIVISION READER		SENT TO OUTSIDE JOURNAL		DATE ORDERED	QUANTITY
DIRECTOR'S APPROVAL TO PUBLISH		<input type="checkbox"/> ACCEPTED <input type="checkbox"/> RETURNED OR REJECTED		DATE 2 COPIES SENT TO DTIP	DATE OIST TO SPONSOR
PROOFS RECEIVED		DTIP NOTIFIED OF PUBLICATION (USE NBS 266)		OTHER OIST	
(1)		(2)			
NOTES					
INSTRUCTIONS: Initiate this form at the same time you prepare NBS-114, Editorial Record, and use it as a check-list and record of date, reprint and publication information. After the article is published, the form will serve as a record of publications by authors. PUBLICATION IN OUTSIDE JOURNALS ONLY As soon as volume, number, page numbers and date of publication are known, send form NBS-266, Notification of Publication in Non-NBS Journal, to Office of Technical Information and Publications. If article is not published, inform the Editorial Committee by memorandum, attaching correspondence.					

USCOMM-NBS-DC

Note: Originating units use NBS-265 to record status of papers from manuscript to publication. NBS-266 is used to notify TIPD that an outside paper has been published along with complete citation information and copies of the paper. See also section 1.3.4.

Exhibit 1-E(f). Notice of Publication in Non-NBS Media, Form NBS-266

NBS-266 (Rev. 5-80)		U.S. DEPARTMENT OF COMMERCE National Bureau of Standards																	
NOTICE OF PUBLICATION IN NON-NBS MEDIA																			
Send this completed notice to Publications/Production Office, Room A-607, Administration Building immediately after the article appears in print, along with NBS-114A, "Bibliographic Data Sheet". If abstract or summary on the published paper has changed since WERB approval, be sure abstract shown on NBS-114A agrees with published abstract. NOTE: Please expedite this notice so that NBS citation records may reflect the Bureau's publication output as promptly as possible.																			
Author(s): (Give authors and new organizational number in the same order as shown in the article, e.g., W.E. Smith, 345, R.S. Jones, 502, etc.)																			
Title of Article																			
Medium:																			
<input type="checkbox"/> Journal <input type="checkbox"/> Book <input type="checkbox"/> Book Chapter <input type="checkbox"/> Encyclopedia Article		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="3" style="padding: 2px;">TITLE OF BOOK, JOURNAL OR PERIODICAL</td> <td style="padding: 2px;">Chapter No.</td> </tr> <tr> <td style="padding: 2px;">VOLUME (IF APPLICABLE)</td> <td style="padding: 2px;">ISSUE NUMBER (IF APPLICABLE)</td> <td style="padding: 2px;">PAGE NUMBERS (INCLUSIVE)</td> <td style="padding: 2px;">DATE OF PUBLICATION</td> </tr> <tr> <td colspan="4" style="padding: 2px;">IF BOOK, NAME OF PUBLISHER AND ADDRESS (CITY/STATE OR TOWN/COUNTRY)</td> </tr> <tr> <td colspan="4" style="height: 40px;"></td> </tr> </table>		TITLE OF BOOK, JOURNAL OR PERIODICAL			Chapter No.	VOLUME (IF APPLICABLE)	ISSUE NUMBER (IF APPLICABLE)	PAGE NUMBERS (INCLUSIVE)	DATE OF PUBLICATION	IF BOOK, NAME OF PUBLISHER AND ADDRESS (CITY/STATE OR TOWN/COUNTRY)							
TITLE OF BOOK, JOURNAL OR PERIODICAL			Chapter No.																
VOLUME (IF APPLICABLE)	ISSUE NUMBER (IF APPLICABLE)	PAGE NUMBERS (INCLUSIVE)	DATE OF PUBLICATION																
IF BOOK, NAME OF PUBLISHER AND ADDRESS (CITY/STATE OR TOWN/COUNTRY)																			
<input type="checkbox"/> Conference Proceedings		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2" style="padding: 2px;">FULL NAME OF CONFERENCE/PROCEEDINGS</td> <td style="padding: 2px;">PAGE NUMBERS (INCLUSIVE)</td> </tr> <tr> <td colspan="2" style="padding: 2px;">PLACE HELD (CITY/STATE OR TOWN/COUNTRY)</td> <td style="padding: 2px;">DATE OF CONFERENCE (MO., DAY(S), YR.)</td> </tr> <tr> <td colspan="2" style="padding: 2px;">NAME OF PUBLISHER AND ADDRESS (CITY/STATE OR TOWN/COUNTRY)</td> <td style="padding: 2px;">DATE OF PUBLICATION</td> </tr> <tr> <td colspan="2" style="height: 40px;"></td> <td></td> </tr> </table>		FULL NAME OF CONFERENCE/PROCEEDINGS		PAGE NUMBERS (INCLUSIVE)	PLACE HELD (CITY/STATE OR TOWN/COUNTRY)		DATE OF CONFERENCE (MO., DAY(S), YR.)	NAME OF PUBLISHER AND ADDRESS (CITY/STATE OR TOWN/COUNTRY)		DATE OF PUBLICATION							
FULL NAME OF CONFERENCE/PROCEEDINGS		PAGE NUMBERS (INCLUSIVE)																	
PLACE HELD (CITY/STATE OR TOWN/COUNTRY)		DATE OF CONFERENCE (MO., DAY(S), YR.)																	
NAME OF PUBLISHER AND ADDRESS (CITY/STATE OR TOWN/COUNTRY)		DATE OF PUBLICATION																	
NOTE: Complete upper blocks and/or lower blocks as applicable. (In many instances, Proceedings are also published in a book with a different title.) If Book, Conference/Proceedings information is confusing, attach Xerox copy of preliminary pages with reprints.																			
Reprints																			
<input type="checkbox"/> TWO ATTACHED <input type="checkbox"/> XEROX ATTACHED, WILL SEND REPRINTS LATER.																			
Notice Prepared By		Extension	Date																
Remarks																			
FOR PRODUCTION USE ONLY																			
Notice Received (Date)		NTIS Notified (Date)																	

USCOMM-NBS-DC

Public Information Division

Distribution

Technical and Trade Press

Code	Category
100	Building Technology (186)
	A Construction & Standards (127)
	B Air Conditioning, Heating, Refrigeration & Plumbing (20)
	C Architecture (20)
	D Select (18)
101	Business, Financial & Government (216)
	A General Business & Management (86)
	B General Industrial (37)
	C Municipal & Government (68)
	D Select (25)
102	Computers & Information Processing (129)
	A General (125)
	B Select (4)
103	Consumer Products & Safety (139)
	A General Consumer & Safety (26)
	B Safety (15)
	C Fire Safety (38)
	D Law Enforcement (34)
	E Clothing, Furnishings, Stores (26)
104	Ecology & Environment (43)
	A General (34)
	B Water Supply & Pollution (4)
	C Solid Waste (5)
105	Education (47)
106	Electronics (85)
	A General (59)
	B Optical (11)
	C Select (15)
107	Engineering (149)
	A General (38)
	B Electrical & Lighting (19)
	C Educators (80)
	D Select (12)
108	Food & Food Processing (48)
109	Fuels & Energy (145)
	A Production (60)
	B Conservation & Solar (30)
	C General (40)
	D Select (15)
110	Health Related (72)
	A General Medicine (56)
	B Dental (11)
	C Hospitals (5)
111	Instrumentation (25)
112	Machinery (33)

Code	Category
114	Materials (216)
	A Ceramics & Glass (17)
	B Chemical (47)
	C General (13)
	D Metals Trade & Mining (51)
	E Paints, Inks & Printing (17)
	F Paper, Packaging, & Lumber (37)
	G Plastics & Polymers (16)
	H Textiles (18)
115	Photography (16)
116	Publications Centers (57)
117	Science (154)
	A General (102)
	B Mathematics & Statistics (3)
	C Physics (10)
	D Marine & Oceanography (9)
	E Atmosphere & Meteorology (6)
	F Sound & Acoustics (7)
	G Cryogenics (10)
	H Nuclear Science (7)
118	Transportation (27)
	A Automotive (24)
	B Aviation & Aerospace (1)
	C Miscellaneous (2)
119	Miscellaneous (13)
	A Operations Research (5)
	B Metric (8)
120	International Standards Organization (3)

General Press

200	Consumer (971)
	A Writers (445)
	B Radio-TV (472)
	C Select (54)
203	Environmental Writers (131)
204	Foreign Press (195)
205	General Science Writers (400)
	A General (352)
	B Select (48)
206	Local Media (101)
207	Medical (146)

Other

300	DOC Offices (330)
301	PIO-Other Agencies (24)
303	NBS-Gaithersburg (126)
	NBS-Boulder
	Miscellaneous

Back side: Media distribution record

Exhibit 1-E(h). Notice of Talk, Form NBS-118
(see next page for review procedures)

NBS-118 (REV. 2-80)		U.S. DEPARTMENT OF COMMERCE NATIONAL BUREAU OF STANDARDS	
NOTICE OF TALK		FOR USE OF EDITORIAL REVIEW BOARD APPROVED _____	
INSTRUCTIONS - Use this form to notify the appropriate Editorial Review Board of proposed talks by NBS staff members to outside groups, and to provide necessary information for listing in the NBS Technicalendar and the BL Weekly Bulletin of talks to be listed. (See reverse for NBS policy and further details.)			
Talks by staff members to outside groups →	Washington Original and 2 copies to WERB c/o Publication Production, Admin. Bldg., Rm. A-607 2 weeks before talk is to be given		Boulder Original and 5 copies to Secretary, Editorial Review Boards.
Talks of interest to NBS Staff for listing in Technicalendar or BL Weekly Bulletin. Complete Section 1 Only →	Original and 1 copy to Publications Production by noon Wednesday		Original to Secretary for Weekly Bulletin by 10:00 A.M. Thursday
Section I			
DATE OF TALK _____		TIME OF TALK _____	
TITLE OF TALK _____			
CONCISE DESCRIPTION OF SUBJECT TO BE COVERED			
SPEAKER(S) AND BUSINESS ADDRESS (Include organization. If NBS staff member, give division.)		IDENTIFY MEETING AND/OR ORGANIZATION SPONSORING TALK	
ADDRESS WHERE TALK WILL BE PRESENTED (If NBS, give building and room)		FOR FURTHER INFORMATION CALL (Name) _____ TELEPHONE _____	
Section II			
1. Will the talk be preprinted for distribution before or at the meeting? <input type="checkbox"/> Yes <input type="checkbox"/> No If answer is yes - Has the required Editorial Review Board release been obtained? <input type="checkbox"/> Yes <input type="checkbox"/> No			
2. Will the talk be published (either in whole or in abstract)? <input type="checkbox"/> Yes <input type="checkbox"/> No If answer is yes - (a) Where will it be published? _____ (b) Check One <input type="checkbox"/> Paper attached for review (with Form NBS-114, Editorial Record). <input type="checkbox"/> Abstract attached. <input type="checkbox"/> Paper will follow (with Form NBS-114, Editorial Record).			
3. Does talk involve new policy matters that must receive Director or DoC approval? <input type="checkbox"/> Yes <input type="checkbox"/> No			
4. Will slides or other visual aids meet minimum NBS specifications (See NBS Publications Manual) <input type="checkbox"/> Yes <input type="checkbox"/> No			
5. For the talk, patent review is: <input type="checkbox"/> In Progress <input type="checkbox"/> Requested <input type="checkbox"/> Not Required			
6. COMMENTS			
SIGNATURE OF SPEAKER OR UNIT CHIEF _____		TELEPHONE EXT. _____	
SIGNATURE OF DIVISION CHIEF _____	DIVISION _____	ROOM & BLDG. NO. _____	DATE _____

USCOMM-DC 80-6014-P80

ORAL PRESENTATIONS REVIEW AND APPROVAL

Review and Approval

When you are invited to speak before an outside group, the Editorial Review Board should be notified by submitting Form NBS-118, "Notice of Talk", at least ten (10) days before the talk is given, and three (3) weeks if the talk is to be given outside of the Gaithersburg or Boulder areas.* If publication of the oral presentation is contemplated, the manuscript is subject to the same review procedures as other papers. An abstract of approximately 200 words must accompany the Form NBS-118 for clearance. Manuscripts and other material reproduced in any form for general distribution before or during a meeting, or for any other prepublication use, must be submitted to the Editorial Review Board for review or noting. The manuscripts should be clearly labeled "Preliminary Draft for Discussion—not for Publication." Editorial review is not required if such a manuscript is distributed to a limited number of colleagues for comments.

Transcripts of tape-recorded speeches intended for publication must also be submitted for appropriate review. You should carefully edit the transcript so as to be suitable for formal publication.

Some organizations publish abstracts of talks that are in themselves short papers. These more extensive abstracts will normally be treated as papers and will be given the same type of review as is given a Letter to the Editor.

* This permits the listing of talks in the NBS Technicalendar in advance, when possible, to advise Department of Commerce District Offices of NBS speaking engagements in their areas.

Exhibit 1-F. Aids to Correspondence (Selected Items)**METRIC**

LC 1035	Units and Systems of Weights and Measures—Their Origins, Development, and Present Status
LC 1120	NBS Guidelines for Use of the Metric System (Reprint from DIM/NBS 12/79 with revisions 8/80)
LC 1070	NBS Metric Information (Bibliography)
LC 1071	Factors for High-Precision Conversion—U.S. Customary and Metric Units
LC 1098	Preferred Metric Units for General Use by the Federal Government
SP 304	Modernized Metric System (Wall Chart)
SP 304A	Brief History of Measurement System with Chart of Modernized Metric System
SP 330	The International System of Units (SI)
SP 365	Metric Conversion Card (pocket card)
SP 430	Household Weights and Measures

ENERGY AND ENERGY SAVINGS (including SOLAR ENERGY)

LC 1092	The NBS/DoE Energy Related Invention Evaluation Program
DIM/NBS Reprint	Fusion Reactors in Our Future? (from DIM/NBS 4/78)
DIM/NBS Reprint	Solar Heating and Cooling: Standards for a Maturing Industry (from DIM/NBS 12/78)
HB 120	Energy Management Guide for Light Industry and Commerce

COMPUTER AND MATHEMATICAL

CIS 10	Automation in the Marketplace
LC 84	Computer Science and Technology Publications
LP 88	The Computer Science and Technology Series—Publications
LP 91	Computer Security Publications
LP 17	Publications Series of the Applied Mathematics Division

HOME SAFETY AND SECURITY

Leaflet	Home Security Starts at Your Door
LC 1079	Home Security Alarms—What They Are and How They Work
LC 1074	Smoke Detectors—What They Are and How They Work
LC 1091	Building Safety

SOME NBS SERVICES

LC 1080	Non-Destructive Evaluation
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SP 250	Calibration and Related Measurement Services of the NBS
SP 260	NBS Standard Reference Materials
LC 1094	NBS Standards Information Service

GENERAL

TFS 602	NBS Time Via Satellites
LP 81	National Standard Reference Data System Publications List
LC 1067-1	Code for the Names of Countries
Smithsonian Mag. Reprint	The National Bureau of Standards—America's Inquisitive Agency
Leaflet	Guidelines for Preparation of Unsolicited Proposals
SP 538	NBS—A National Resource for Science and Technology
CIS 4	Facts About Hearing and Hearing Aids
LP 80	NBS Publication Program—A Descriptive Brochure
LP 87	Publications of the NBS by Subject Category
LC 1075	Measurement Technology for the Marketplace

GENERAL PHYSICAL CONSTANTS

SP 368	Electrical Engineering Units and Constants (pocket card)
SP 398	Fundamental Physical Constants (pocket card)

Chapter 2

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Chapter 2

Writing for Publication

The following guidelines are provided to assist NBS authors, reviewers, editors, and others concerned with effective writing in the communication of the results of NBS activities. A number of the suggestions in this chapter have been adapted from *American National Standard for the Preparation of Scientific Papers for Written or Oral Presentation* (Z39.16-1979). Instructions for secretaries and the clerical staff are given in chapter 4.

2.1 Importance of Good Writing

It is the responsibility of the NBS professional staff to report findings clearly, completely, and concisely. The writings of the NBS staff cover an extremely broad range of subjects, including not only the physical sciences and engineering but also biology, psychology, economics, regulatory affairs, and others. Clearly a standard format for manuscripts in such a wide range of subjects is neither possible nor even desirable. Even within a given subject, NBS authors' tastes and predilections range widely.

The NBS committee preparing this manual has no desire to tell the staff exactly how to write papers. Instead, the committee provides general guidelines on what constitutes good writing along with policy guidelines of importance to NBS authors. In addition, examples of good and poor scientific writing are given to illustrate the principles of clear, direct, and concise style.

Of course, the quality of the experiments, theories, ideas, results, or discoveries in NBS research and development are of foremost importance. However, good writing is also important for effective communication of these results to the intended audiences.

2.2 Stages of Preparing a Paper

2.2.1 Defining Purpose, Scope, and Audience

Before writing a paper, authors should clearly define its purpose and scope, and identify its

intended audience. When considering its purpose, authors should be sure that the work is sufficiently complete for reporting. If the work is fragmentary, the author may consider presenting the information as a short note, a brief communication, or a letter to the editor. An exception to this guideline is if the author is conducting a series of experiments requiring several years to complete.

Before actually writing the paper, authors should be able to define its purpose in a few words. Generally, they should also be able to place their work in the context of what has already been accomplished in the field and to explain the significance of their findings. With this definition, an author may avoid producing a paper that is rambling, too detailed, too narrow, or too shallow.

The intended scope of the paper should also be considered. For example, a paper could be a detailed, comprehensive study or a brief interim report or a report of only one specific aspect of the research.

Another important concern is identification of the primary audience for whom the paper is intended. This identification will affect the content, organization, and vocabulary used in the paper, as well as the medium of publication. Some NBS series are better suited for one audience than others. Often a non-NBS journal will best reach the intended audience (see ch. 3 for guidance in selecting a medium of publication).

When identifying the audience, authors should consider the need of not only the primary audience—usually specialists in the field—but also the secondary audience—usually less specialized readers. The secondary audience will not always readily understand jargon, abbreviations, and shortcuts in logic. Proper consideration of both groups of readers may affect the content and style of the final paper.

2.2.2 Setting Style and Format

Format and style requirements are substantially influenced by the chosen medium of publication; therefore, authors and their staff should become familiar with the format and style before writing begins.

The Technical Information and Publications Division (TIPD) uses the *U.S. Government Printing Office Style Manual* as the primary style guide for NBS in-house publications, along with the style guides of the American Institute of Physics and the American Chemical Society. In addition, TIPD consults the Department of Commerce (DoC), *Handbook of Publishing and Printing* to be sure NBS publications conform with DoC policy and style. For abbreviations, TIPD uses the forms listed in exhibits 2-D and 2-F.

Bibliographies 2-A through 2-D list style manuals and other books concerning scientific and technical writing, which may interest NBS authors.

2.2.3 Organizing the Paper

Authors can save time by organizing a paper before actually starting to write it. At intervals during an investigation, they may wish to review on paper the status of the project. An outline can be done at progressive stages throughout the research, with more detail each time. In this way, a detailed skeleton of the paper will be complete even before writing begins.

2.2.4 Writing the First Draft

The object of the first draft is to flesh out the outline, not to produce a polished, finished paper. It is probably unreasonable to expect the first draft to be well written. At this stage, it is better to capture as many ideas as possible, whereas searching for the right word, editing, and revising can result in losing an important idea.

2.2.5 Revising the First Draft

If time permits, the first draft should be allowed to sit for a while. Then, the author can revise it more objectively. During the revision authors can search for the right word, provide connections between ideas, correct faulty grammar, evaluate the logic of the presentation, and verify the spelling of words. Slowly a polished version will emerge (see also secs. 2.5 to 2.22). For final review the author should use the Checklist for Authors and Reviewers, exhibit 2-A. An example of a well-written, concise scientific paper is provided in exhibit 2-B.

2.2.6 Proofreading

Proofreading is different from editing a manuscript. Proofreading is the process of ensuring that the typeset material corresponds exactly with the manuscript from which it was prepared. The number of times a manuscript is proofread depends

upon the place or method of publication (see ch. 3). The final manuscript should be proofread at least once before submitting it for publication. This usually is the last chance to proof typewritten camera-ready copy. For material set in type, at least one more chance is provided. At NBS, proofreading of manuscripts, galleys, and page proofs is the responsibility of the originating organization.

Changes are not generally allowed after the manuscript has been submitted to the printer and is in the composition stage, because such changes are very costly. However, it is important to note printer's errors and errors of fact (see exh. 2-C for standard proofing symbols). Detailed guidance in proofreading is given in *American National Standard for Proof Corrections* (Z39.22-1974).

2.3 Recognizing Outstanding Writing Achievements

The Bureau encourages supervisors to use the incentive awards program as a mechanism for recognizing outstanding writing achievements of the staff. In addition, a major Bureau award, the Edward Uhler Condon Award, is given annually for distinguished achievement in written exposition (see sec. 1.3.12 for details about these awards).

2.4 Policy Guidelines of Special Interest to Authors

2.4.1 Units

The official NBS policy is to encourage and lead in the use of the International System of Units (SI). This system is explained in exhibit 2-D.

2.4.2 Expression of the Uncertainties of Final Results

The current NBS guidelines regarding the expression of the uncertainties of final results are presented in exhibit 2-E.

2.4.3 Trade Names

Authors should avoid the use of trade names in all manuscripts (including illustrations) except where public safety or health is involved or where mention of the trade name would not result in a competitive advantage or disadvantage to the manufacturer. This Bureau policy complies with the regulations of the Joint Committee on Printing. In general, authors should use generic terminology rather than specific commercial identification (see secs. 1.4.11 through 1.4.12 for detailed policy and discussion of exceptions).

2.5 Readability and Accuracy of Expression

Effective scientific and technical writing is precise, clear, concise, and direct. Words should be selected as carefully as possible. Authors should make sure that terms commonly used in the laboratory are understood by intended readers; if ambiguity is possible, such terms should be carefully defined when first used.

Authors should express their ideas as concisely and simply as possible without sacrificing accuracy or clarity. Some ways to make writing more clear and concise are as follows:

- (1) Substitute verbs for abstract nouns wherever possible.

ORIGINAL

The *decision* was made by a committee.

REVISION

A committee *decided* that....

- (2) Authors should preferably limit the total number of modifiers per noun to three. (These modifiers include nouns, adjectives, and adverbs.) Prepositional phrases help break up bulky noun phrases.

ORIGINAL

Electronic component production equipment maintenance costs....

REVISION

Costs of maintaining equipment that produces electronic components....

- (3) Where appropriate, authors should use the active voice as well as the passive voice. When a verb concerns action by the author, the author may occasionally use the first person, although overuse of the first person can distract the reader.

ORIGINAL

It was found that....

REVISION

We found that....

Authors who have difficulty writing acceptable English should seek assistance from colleagues who write correctly and well. Editors and reviewers are not expected to rewrite papers to correct language problems.

2.6 Examples of Good and Poor Writing

A clear grammatical style does not come easily to everyone. It needs to be developed. There are at least two prerequisites: clear thinking and a knowledge of usage. Thereafter, a good style can result from practice over a period of years and from ability to criticize and revise one's own work.

The following examples illustrate good and poor scientific writing:

EXAMPLE 1¹

(Clear, concise, and direct.)

"The basis of classical mechanics is contained in Newton's three laws of motion (1687). According to the first of these, a body moves uniformly in a straight line if not acted on by a force. According to the second, the rate of change of momentum of a particle is proportional to the resultant force acting. According to the third, the force acting on particle *i* due to any kind of interaction with particle *j* is equal and opposite to that acting on *j* due to interaction with *i* and acts in the direction of the line joining *i* and *j*."

EXAMPLE 2

ORIGINAL

(Wordy and tedious.)

It was recognized that if a resonance should occur, large losses would be introduced in the range of the resonance frequency and that from a practical viewpoint the transformer could not be used in such a region. (37 words)

REVISION

(Concise and vigorous.)

If resonance should occur, the resulting losses would make the transformer useless in the resonance frequency range. (17 words)

See exhibit 2-B for a sample of a well-written scientific paper.

2.7 Gender Terminology

Traditionally, masculine nouns and pronouns were acceptable for use in statements applying to either sex. But this usage is changing to reflect the significant change of the role of women in society. Many people are offended by the traditional usage, which can be interpreted to reflect a male dominant role.

¹ From Condon, E. U., *Dynamical Principles*, Condon, E. U., and Odishaw, H. eds. *Handbook of Physics*, 2d Ed., New York: McGraw-Hill, 1967. p.2-11.

One step in removing unintentional sexism is to avoid any use of gender-specific pronouns (he, she, him, her) in nonspecific situations. The author should do so without resorting to an abundance of awkward his/her constructions. As an example, instead of

The *scientist* should verify the accuracy of *his* data.

It would be preferable to say

Scientists should verify the accuracy of *their* data.

or

The *scientist* should verify the accuracy of *the* data.

Another step is to use substitutions for words that begin or end with "man" in nonspecific situations.

chairman—chairperson, chair, head
manpower—workforce, workers, human power,
human energy
congressman—representative, member of
Congress
men—persons, people
manhours—staff hours

2.8 Title²

The title should be concise and informative, using words that the author would use if searching for the paper by topic. The author should omit unnecessary words, such as "a report on..." or "an in-depth study of..." To make the title meaningful to a wide audience, the author should avoid abbreviations, symbols, formulas, and jargon.

² Much of the material in sections 2.8 to 2.22 has been adapted from *American National Standard for the Preparation of Scientific Papers for Written or Oral Presentation* (Z39.16, 1979). New York: American National Standards Institute; 1979, 16 p.

2.9 Byline

2.9.1 Identifying Authors

At NBS the decision to include a person as an author should be made at the project level and should be based on a substantial and truly professional contribution by the person so named. Mere administrative supervision of the work is not a sufficient qualification for authorship. The order in which the authors' names appear should also be decided at the project level, and as with authorship itself should only be carried to the next higher administrative authority for resolution if a conflict arises at the project level. Alphabetical ordering may be used. (In a multi-authored paper, it is not expected that all authors be able to explain or defend all points in the paper.)

Ordered attribution is useful not only in crediting contributions but also in signaling the audience who the principal contact is for further information. Sometimes this individual is not the same as the "principal contributor," as when a chairperson of a committee issuing a report may have only given oversight to the work but nevertheless should serve as the contact for the audience. When this is the case, the principal contact should be identified by footnote along with that person's role, if appropriate.

2.9.2 Form of Identification

(1) NBS Staff

The author's official affiliation with the Bureau must be shown on all official writing.

The major operating units have agreed on a uniform and preferred method for indicating the NBS author's affiliation for manuscripts published by the Bureau, as well as for those published in non-NBS publications if not otherwise specified by the outside publisher. The following format is preferred:

General form	Example
Author's name* National Bureau of Standards Washington, DC 20234 or Boulder, CO 80303 *In a footnote, list the division or program, the center, and the laboratory or institute. For journal and proceedings papers, place the footnote at the bottom of the page; for monographs and other separate publications, place the footnote above the Department of Commerce/NBS seal on the title page.	John Smith* National Bureau of Standards Washington, DC 20234 *Building Economics and Regulatory Technology Division, Center for Building Technology, National Engineering Laboratory

This format allows for the “preferred” minimal, meaningful organizational identity or, when appropriate, a fuller identification, including the author’s title. Multiple affiliations or credits can usually be accommodated on one line (e.g., National Bureau of Standards and University of Colorado).

The byline of nonofficial manuscripts may not identify authors in their official capacity at the Bureau; such manuscripts may indicate affiliation with NBS by footnote or other manner but must make clear that the author is writing as a private individual and not as a member of the Bureau staff (DoC Administrative Order 219-1).

(2) Associates and Guests

Papers written by postdoctoral research associates and industrial research associates are reviewed and published under the NBS policies and procedures prescribed in this manual. The status of the associates should be indicated on the title page of their papers or by a footnote of the following form:

NRC-NAS Postdoctoral
Research Associate, 1979-80

or

Research Associate, XYZ
Trade Association (include years,
if appropriate)

Papers by NBS guest workers collaborating with NBS staff members or producing papers as sole authors, should exhibit the guest workers’ affiliations as well as the NBS affiliation.

(3) Staff Members on Training Assignment

If a paper is written when an NBS employee is away at another institution on an authorized assignment and the paper is not submitted for NBS editorial review, it should carry the name of that institution in the author’s byline. Papers receiving NBS review may carry the name of either the training institution, NBS, or both, depending on the wishes of the institution. A footnote should state that the author was at the institution for the period during which the work was done.

2.10 Abstract

For NBS in-house publications the abstract is an integral part of a manuscript and is published with the paper. Abstracts must also accompany all other NBS manuscripts submitted for ERB review, i.e., for non-NBS media, and must be suitable for separate publication in the Journal of Research, in NBS publication catalogs, and in various outside abstract journals. Thus, even though an outside

journal may not require an abstract, it is important that a publishable abstract be prepared and included on Form NBS-114A (Bibliographic Data Sheet). The abstract also assists the editorial review board in choosing readers for the paper.

The abstract should be an “x ray” of the paper, showing in microcosm the whole purpose, nature, and results of the study. It is usually about 200 words long for NBS publications and should address the following questions:

- What problem was examined or procedure carried out?
- What was the objective of the activity being documented?
- What was the scope of the activity?
- What were the principal conclusions and recommendations?

Abstracts should have complete sentences, and should not contain unnecessary contractions and abbreviations that are inappropriate for the main text. Also, sections or illustrations should not be cited by their numerical references in the text and display equations, tables, and figures should be avoided where possible.

For additional guidance, authors may examine *American National Standards for Writing Abstracts* (Z39.18-1974), available from the NBS storeroom.

2.11 Key Words

As in the case of abstracts, key words are an integral part of a manuscript and will be published with the paper if scheduled for an NBS in-house publication. Key words must also accompany all other NBS manuscripts submitted for ERB review, i.e., for non-NBS media, and must be suitable for separate publication with the abstract.

Key words should be words, terms, or phrases that give a clear, precise indication to the reader of pertinent subjects covered in a specific paper. Between 6 and 12 key words should be used to indicate contents of NBS papers and are usually best selected by the author. These words will be used as later entries in an NBS subject index publications catalog and should be cited exactly as they will appear in this index. Thus the author should provide an entry for every route that a potentially interested reader might follow in trying to find a paper. If a key word is omitted, it will not be listed in the index, thus eliminating that search route. Semicolons (;) should be used to separate the index terms since commas may be necessary within some entries. Key words must be included on Form NBS-114A.

The following suggestions are offered to authors:

- (1) Include the obvious.
- (2) Search the title and abstract for possible entries.
- (3) List the research area, general type of study, or general class of processes examined.
- (4) Identify the specific problem studied and the method used.
- (5) Indicate the type of results reported.
- (6) Use synonyms freely or suggest cross references.
- (7) Remember that the potential reader may not be an expert in the field.

EXAMPLE³

Key words: aqueous solution; equilibrium; humidity; relative humidity; salt; saturated salt solution; vapor pressure; water vapor.

The Technical Information and Publications Division in Gaithersburg, or the Program Information Office in Boulder can give further assistance.

2.12 Organization of the Paper

Although there is a wide range of acceptable forms, authors of scientific and technical papers often structure their papers as follows:

- (1) Introduction—(directed to specialist and nonspecialist readers) includes purpose, scope, and background of work;
- (2) Methods—(directed to specialist readers) may include a subsection on materials;
- (3) Results—(directed to specialist readers);
- (4) Discussion—(directed to specialist readers) includes a statement of conclusions and elaboration on their significance;
- (5) Summary—(directed to specialist and nonspecialist readers) optional.

Even though the above structure is a common one for journal articles, not all papers need include all of the elements, or in this order. Other types of papers are brief notes, editorials, engineering specifications, chemical papers in which experimental details are placed at the end, and mathematical papers in which methods are often

part of the results. In addition, some journals prefer that major conclusions be presented at the beginning of the paper.

Thus the structure of a paper is determined in part by convention, in part by journal requirements, and in part by the authors' own good judgment as to how they can best communicate their findings.

2.13 Introduction

In the introduction authors generally state the purpose of the work, the hypothesis tested (if there is one), the background of the study, and the scope of the investigation. The readers should be told exactly what question(s) will be discussed in the paper, and in a long paper an outline of the rest of the paper may be included at the outset.

Because many papers will be read by both specialists and nonspecialists, the author should make the introduction understandable to both, especially statements about the purpose of the work.

The introduction is an appropriate place for authors to credit others for what is already known about the subject. Although this is an important responsibility for authors, they generally should not begin an original scientific article by presenting an exhaustive critical review of all the scholarly work in the field. Such a review is best published separately.

2.14 Methods

At the start of this section, or immediately preceding it, authors should include a description of the overall experimental design or theoretical procedures. The exception is when a specialist reader can easily deduce the design and procedures from the introduction. In addition, this section should give premises and assumptions in the design and support the methods chosen in the investigation when reasonable alternatives exist.

While it is usually the aim of this section to give enough information for colleagues or peers in the field to reproduce the results obtained, for the sake of brevity authors customarily describe in detail only what is new or innovative in the procedures and operations. References to prior published work are given for the rest of the procedures and operations. Even in this abbreviated form, procedures should be presented in a logical order so that the reader can see the relationship of the procedures and the experimental design.

Sometimes the work involves underlying sciences that are referred to as soft and multidisciplinary and the resulting data may be incomplete and subject to

³ From Greenspan, Lewis, Humidity fixed points of binary saturated aqueous solutions, J. Res. Nat. Bur. Stand. (U.S.), 81A(1):89-96; 1977 January-February.

a variety of interpretations. In such instances, authors must be particularly careful to reveal their methodology, the limitations of the data, and the uncertainties in the inferences and stated outcome.

The methods section may also include descriptions of special apparatus and a subsection labeled "materials," which describes the materials used and their preparation or source.

2.15 Results

In this section authors should present information in an order that either logically relates to the hypothesis or answers questions posed in the introduction. They should limit its contents to data and illustrative material that are relevant to the purpose of the paper.

Tables and figures are often the best ways to present results. Authors need not repeat in detail in the text numerical data already provided in tables, although restatement of average values for group data can help emphasize the evidence on which authors may have based their conclusions.

2.16 Discussion

In this section, authors elaborate on their results. This includes relating them to previous and related findings; discussing the impact of their results; and showing what is different from the work of others, including contradictory evidence when appropriate.

Tables and figures should be included in this section only when they contribute to an argument and should be presented in a logical order. As in the results section, the author should refrain from extensively repeating results that are included in the tables and figures and only make references to them as appropriate.

Authors should discuss the work of others with care and focus such comments on the scientific aspects of their published work.

In their comments on the significance of their findings, authors may speculate provided (1) they identify such comments as speculation, (2) the speculation stays close to experimental observations or proved theorems, (3) the speculation is concise, and (4) the speculation is capable of being further investigated. However, the author should not inhibit relevant speculation just because empirical observations are not yet possible. To do so might impede the scientific process.

When trying to explain the reasons for a set of results, authors should not state all possible hypotheses in the hope that one may be correct. Nor should they overstate the precision of the work, the generality of the conclusions, or the applicability of the results.

2.17 Summary

The summary is an optional section, which either stands separate or is incorporated at the close of the discussion. Like the introduction, the summary should be directed to both specialists and nonspecialists.

A summary differs from an abstract. The summary's concise conclusions are intended for someone who has read the entire paper, but an abstract is intended for someone who has not yet done so.

2.18 Illustrative Materials

Illustrative materials include tables, graphs, photographs, and figures. Authors should select these materials before writing the text so they may adequately discuss these items in the text. In addition, they should provide a title for each piece of illustrative material.

For the best reproductions, authors should submit camera-ready originals or good photographic prints, not copies from quick copying machines.

2.18.1 Tables

Tables are used to present numerical data in a compact and logical format. If possible, the reader should be able to use the tables without referring to the text. To enable the reader to do this, the author should carefully select titles and column headings and use table footnotes and logical arrangements of values. As a result, the reader should be able to see the purpose, design, method, and main conclusions of the experiment(s) or theoretical procedure(s) from which the table is derived. Tables are clearer when values to be compared are placed in adjacent columns or rows, and when "baseline values," if used, are in the first column or row.

If authors wish to record voluminous data for possible future retrieval (especially if many individual results might be useful to another specialist but not to most readers), they should deposit the data in a national depository and retrieval center. NBS authors may use the NBS Interagency/Internal Report series for this purpose; such reports are deposited with the National Technical Information Service for public availability. Another alternative is to publish a relatively small quantity of such data as an appendix.

The statistical treatment of results should be clearly indicated. For example, uncertainty in values should be shown either as ranges or as the standard deviations of individual values; or implied by the standard error of means or of least square values of parameters. Authors must state, in a convenient place such as a table footnote, whether the table shows standard deviations or standard

errors, and must indicate how many observations were used to derive these values or the range. When authors give statistical estimates of significance, they should justify or reference uncommon or atypically used tests (see exh. 2-E).

2.18.2 Graphs

While tables are used for presenting numerical data, graphs are better for illustrating trends and relationships. As with tables, graphs should be intelligible without reference to the text. This means titles, labels, and legends that clarify the purpose, design, method, and main conclusions of the experiment(s) or theoretical procedure(s) from which the graph is derived. This also means labeling coordinates and the units of measure given.

The number of curves in the graph should not be so many as to prevent easily following of each curve over its whole length. And to be readable, letters and numerals must be at least 1.5 mm high after reduction to fit the publication format.

If authors choose to extrapolate beyond or interpolate between determined points in line graphs, they should carefully consider their justification for doing so, and, when appropriate, explain the justification to the reader.

If possible, authors should present the uncertainty of values for each point, either as such or as a vertical line representing magnitude as stated in the legend.

2.18.3 Photographs

Photographs of equipment are usually less useful as illustrative devices than line drawings or verbal descriptions that make clear how the equipment operates. If photographs are used, authors should use arrows or letters to clearly point out elements of interest. Also, the center of interest should be at the same point as the center of the field. To have effective photographs, authors should crop unimportant details or note crop marks in the margins.

Photomicrographs and electron micrographs should be of top quality. To compensate for errors in calculating magnification after such photographs are reduced to fit a format, the author should include a measured bar in the photograph to show the scale.

2.18.4 Line Drawings

Crowded illustrations often confuse the reader. Thus, authors should limit lines and letters to the minimum number needed to convey meaning. They should also be sure lines are heavy enough and letters large enough to be readable after reduction in size.

2.18.5 Other Figures

Authors should have a clear reason for using any figure. This includes automatically recorded tracings or computer printouts. Authors should not use a figure just because it is available.

2.19 Acknowledgments

At NBS acknowledgments of aid should be made to individuals or groups who have made significant contributions to the paper but who cannot properly be regarded as authors of the paper. When acknowledgment is made for assistance in a specialized field, the individual or group to whom acknowledgment is named should be given the opportunity to review the paper and make comments.

Acknowledgments should be the last section of the text, in a separate paragraph.

2.20 References

2.20.1 Distinction Between "References Cited" and "Bibliography"

A list of references ("references cited") contains only those sources cited in the text, whereas a bibliography contains other literature of interest to the reader. If authors include both types of references in a paper, they should construct two separate, appropriately labeled lists.

2.20.2 References to Unpublished Work, Personal Communications, and Documents With Limited Distribution

Unless absolutely necessary, lists of references should not include references to manuscripts being prepared, to technical reports with limited distribution, to unpublished work, or to personal communications. Editors often require authors to integrate such references into the text.

Authors should cite documents with limited distribution, only if they tell readers how the documents can be obtained. If such a document is not available on request for reasons of Government or company regulations, authors should indicate this and should provide all the information from the document that the reader would need. However, if this would violate the intent of the restriction, authors should not reference or use the information from the restricted document.

2.20.3 Accuracy and Completeness

Authors should prepare references that are bibliographically complete and accurate. The form

used depends upon the journal in which the paper will be published. NBS authors writing for NBS in-house publications should use the forms given in exhibit 4-E and section 4.4.11.

An alternative and acceptable method for literature references is often referred to as the Oxford, Harvard, or Science Method. In this method, the references in the text are indicated by the bracketed insertion of the author's name and the year of publication: [Smith, 1960]. If the author's name is part of the text, only the year is shown in brackets [1960]. When more than one paper is cited in the same year by the same author, the references are distinguished by the letters "a, b, c" etc. after the year. References to two or more papers within the same brackets are given in chronological order: [Smith, 1960; Jones and Taylor, 1964]. In the reference section at the end of the manuscript all references are cited in alphabetical order and in the style recommended in section 4.4.11.

For further guidance, NBS authors should consult the style manuals of the American Institute of Physics, the American Chemical Society, or others listed in bibliography 2-D.

2.21 Text Footnotes

Authors should limit footnotes to peripherally related information that would seriously disrupt the train of thought if included in the text. Footnotes should be placed in accordance with the instructions of NBS or the outside journal (see sec. 4.4.13).

2.22 Appendixes

Authors sometimes use appendixes to publish lengthy proofs, subsidiary arguments, or data not essential to the argument but of interest to some specialists. Unlike a note added in proof, an appendix is considered an integral part of the paper and is reviewed as such.

2.23 Writing for *DIMENSIONS/NBS*

The monthly magazine *DIMENSIONS/NBS* is a product of the Public Information Division (PID). This magazine describes in technical and general terms results of NBS activities in areas of basic research and national concern. The publication has three major sections: staff reports describing in technical terms ongoing or completed research; feature articles written for the nonspecialist; and brief articles describing industry and standards-related programs, often involving technology transfer.

Although the editor of *DIMENSIONS/NBS* generally solicits manuscripts from the staff, members of the staff are encouraged to contact the editor if they would like to write for it. The editor will work with authors to plan the initial draft and to guide them through the publication process (see sec. 3.2 for a detailed description of *DIMENSIONS/NBS*).

2.23.1 Staff Reports

"Staff Reports" is a section in *DIMENSIONS/NBS* intended to give NBS researchers the opportunity to report briefly on developments in the laboratory to scientific colleagues and directors of research who may not be experts in the field. This section of the magazine also discusses NBS technical services. Over the course of a year, this section tries to reflect the breadth of NBS technical activities and features most major technical developments that occur during that time. The following are guidelines for "Staff Reports:"

- (1) Before beginning a staff report, authors should contact the *DIMENSIONS/NBS* editor. In Boulder contact the Program Information Office (PIO).
- (2) Selection of subjects—the choice of staff report topics is the prerogative of each technical unit. Authors are encouraged to contact the editor with suggested topics.
- (3) Preparation of articles—In general, staff reports are drafted by the scientist(s) or engineer(s) most directly involved in the program under discussion and edited by the *DIMENSIONS/NBS* editor.
- (4) Format—Each report on an area of research begins with a paragraph that highlights the significance of the development. This introduction is followed by the name(s) of the individual(s) primarily responsible for the work, along with the division, address, and phone number of each person. This is followed by the body of the article.
- (5) Style guidelines—The body of an article should be written in narrative form, using the first person (I or we) to describe the development and its ramifications in as much technical detail as is appropriate in a maximum of four double-spaced manuscript pages. (Some reports run less than one manuscript page.) Authors should discuss the subject in technical terms, but should write for colleagues outside their specific discipline. Wherever appropriate, technical illustrations with captions should accompany the text.

2.23.2 Other Sections

Authors planning to write a feature article or a brief article describing industry and standards-related programs should contact the editor of

DIMENSIONS/NBS. In Boulder contact PIO. These articles are generally written in a popular style and include less detailed technical information than a staff report.

2.24 Writing for the *NBS Standard*

The *NBS Standard* is issued biweekly to all members of the NBS staff. It is the official employee publication and reports on employee activities and Bureau programs. All employees are invited to contribute articles to the *NBS Standard*. Those staff members wishing to write a story or article should first contact the editor of this publication. In Boulder contact PIO.

2.25 Writing for the *Monthly Highlights*

The *Monthly Highlights* is designed to keep NBS management informed of significant events involving the Bureau, its programs, and its staff. The information in this publication is for internal use only.

The entries for *Monthly Highlights* are generated at the project level and compiled by each major operating unit (MOU). Final coordination is handled by PID. For the most part, the content and style are the responsibility of the originating MOU, but these general guidelines should be kept in mind:

- (1) Make contributions brief and factual.
- (2) Use names and dates when possible—for example, when discussing publication of significant technical articles, start-up of new equipment, receipt of an award, and significant meetings about a major national problem.
- (3) Note the relative importance of the event discussed—for example, magnitude of the problem,

cost, savings to be accrued, and interest shown in the problem.

- (4) Submit highlights to division chiefs, who will in turn submit them to the designated contact in each MOU. A list of these contacts is available from PID. In Boulder contact the Program Coordination Office.

2.26 Producing a General Publication

If NBS staff members are interested in producing a general publication, they should contact PID, or in Boulder, PIO. Publications that fall into this category include flyers, brochures (general interest and program), annual reports (Bureau-wide and program), employee newsletters, magazines, consumer information booklets, and recruiting materials. After the initial contact, a planning meeting will be scheduled involving the author, the public information specialist covering the author's area, and the PID publications coordinator. The PID publications coordinator then works with the author to produce an appropriate manuscript. The final manuscript must be cleared through the author, the author's supervisor, the appropriate public information specialist, the PID publications coordinator, and the PID general publications supervisor. Those manuscripts containing technical information are also cleared through the appropriate Editorial Review Board.

After approval of the manuscript, the PID publications coordinator arranges for the design, layout, and production of the publication, obtaining clearances on the camera-ready copy from the author and the PID general publications supervisor. After the publication is received, the public information specialist proceeds with a promotional plan for announcing the availability of the publication.

Exhibit 2-A. Checklist for Authors and Reviewers

It is important to pay particular attention to the following items when writing or reviewing a manuscript:

1. Text presentation
 - a. Text is internally consistent as to nomenclature, abbreviations, and units (see exhs. 2-F and 2-D for guidance in use of abbreviations and units).
- b. Style and form are suited to the proposed medium and prospective readers.
- c. Length is appropriate for the medium and for the amount of material to be communicated.
2. Content
 - a. Paper clearly indicates the problem with which it is concerned.

- b. Contribution of paper to the problem is readily apparent.
- c. Premises and methodology used are sound.
- d. Materials studied or employed are clearly characterized (e.g., composition and purity).
- e. Evidence is given about how and against what the instruments used were calibrated.
- f. Measurements are adequate in scope and number to support conclusions reached.
- g. Uncertainties of reported numerical values are stated without ambiguity. For example, distinction is made between systematic errors and random error (see exh. 2-E).
- h. Fitting of data to mathematical models is clearly described. Details and accuracy of computational procedures are treated adequately.
- i. Data are given in sufficient detail to permit comparison with other studies and quantitative evaluations.
- j. Individuals supplying specialized assistance are acknowledged and given an opportunity to review text.

3. Illustrations, tables, and references

- a. Figures are adequately notated with preferred SI Units and are consistent with units used in the text. Caption is a complete statement of the significance of the data displayed in the figure.
- b. Tables are concise but informative. Column headings are adequate and data is properly treated statistically when applicable. Footnotes are adequate. Title is a complete statement of the significance of the data listed in the table.
- c. Citations are adequate and correctly presented.

4. Title, abstract, and key words

- a. Title is informative and well phrased.
- b. Chemical names are spelled out when appropriate; abbreviations and acronyms are not used unless definitions are quite clear to the intended audience.
- c. Abstract is suitable for publishing separately from the paper; it indicates the purpose of the investigation, the type of approach (experimental or theoretical), results, and conclusions.
- d. Units and symbols used are approved for NBS publications (see exhs 2-D and 2-F).

e. Key words are suitable for separate subject indexing of the paper. (Note: Bureau publication records include the abstract and key words for all publications, including non-NBS media having formats that do not require these elements.)

5. Policy matters

- a. SI unit names and symbols are used (see exh. 2-D).
- b. Trade names are used only when necessary. When they are used, NBS policy requirements are satisfied (see secs. 1.4.11 to 1.4.12).
- c. Document is free of statements that extend beyond the authority of the Bureau, the Department, or the Federal Government.

6. Medium of Publication

- a. Publication in an NBS series has been considered.
- b. The journal chosen reaches its intended audience in the United States.
- c. If a foreign journal is chosen, approval of the center director or the Director NBS/Boulder has been obtained.
- d. For a book chapter, the author has provided details of the invitation, claimed an honorarium or royalty on behalf of NBS, arranged for complimentary reprints for NBS, and included a statement that this material cannot be copyrighted (see sec. 1.4.6).

7. Accompanying forms

- a. The manuscript is accompanied by the appropriate forms including Forms NBS-114 and 114A (original and one copy of each), and Form NBS-214, a form used primarily by the Editorial Review Board reader and sponsor. In Boulder, Form BL-7A replaces Form NBS-214.
- b. The title on Forms NBS-114 and 114A is identical to that appearing on the manuscript text. Likewise the authors' names are identical to those on the manuscript and are listed in the same order.
- c. Form NBS-114A is properly completed, including the sections for the abstract and key words or phrases.
- d. The forms have signatures appropriate for the state of review that the manuscript has reached, and the Manuscript Custody Transfer Record (printed on Form NBS-114) is used to give additional indication of the review history of the manuscript.

Exhibit 2-B. Sample Scientific Paper

This work was the basis for the 1962 Nobel Prize for physiology or medicine. It is written in a clear and concise style that is suitable for scientific and technical papers. (In format it is, of course, both shorter and simpler than many such papers.)

No. 4356 April 25, 1953

NATURE

737

MOLECULAR STRUCTURE OF
NUCLEIC ACIDS

A Structure for Deoxyribose Nucleic Acid

WE wish to suggest a structure for the salt of deoxyribose nucleic acid (D.N.A.). This structure has novel features which are of considerable biological interest.

A structure for nucleic acid has already been proposed by Pauling and Corey¹. They kindly made their manuscript available to us in advance of publication. Their model consists of three intertwined chains, with the phosphates near the fibre axis, and the bases on the outside. In our opinion, this structure is unsatisfactory for two reasons: (1) We believe that the material which gives the X-ray diagrams is the salt, not the free acid. Without the acidic hydrogen atoms it is not clear what forces would hold the structure together, especially as the negatively charged phosphates near the axis will repel each other. (2) Some of the van der Waals distances appear to be too small.

Another three-chain structure has also been suggested by Fraser (in the press). In his model the phosphates are on the outside and the bases on the inside, linked together by hydrogen bonds. This structure as described is rather ill-defined, and for this reason we shall not comment on it.



This figure is purely diagrammatic. The two ribbons symbolize the two phosphate-sugar chains, and the horizontal rods the pairs of bases holding the chains together. The vertical line marks the fibre axis.

There is a residue on each chain every 3.4 Å. in the z-direction. We have assumed an angle of 36° between adjacent residues in the same chain, so that the structure repeats after 10 residues on each chain, that is, after 34 Å. The distance of a phosphorus atom from the fibre axis is 10 Å. As the phosphates are on the outside, cations have easy access to them.

The structure is an open one, and its water content is rather high. At lower water contents we would expect the bases to tilt so that the structure could become more compact.

The novel feature of the structure is the manner in which the two chains are held together by the purine and pyrimidine bases. The planes of the bases are perpendicular to the fibre axis. They are joined

together in pairs, a single base from one chain being hydrogen-bonded to a single base from the other chain, so that the two lie side by side with identical z-co-ordinates. One of the pair must be a purine and the other a pyrimidine for bonding to occur. The hydrogen bonds are made as follows: purine position 1 to pyrimidine position 1; purine position 6 to pyrimidine position 6.

If it is assumed that the bases only occur in the structure in the most plausible tautomeric forms (that is, with the keto rather than the enol configurations) it is found that only specific pairs of bases can bond together. These pairs are: adenine (purine) with thymine (pyrimidine), and guanine (purine) with cytosine (pyrimidine).

In other words, if an adenine forms one member of a pair, on either chain, then on these assumptions the other member must be thymine; similarly for guanine and cytosine. The sequence of bases on a single chain does not appear to be restricted in any way. However, if only specific pairs of bases can be formed, it follows that if the sequence of bases on one chain is given, then the sequence on the other chain is automatically determined.

It has been found experimentally^{3,4} that the ratio of the amounts of adenine to thymine, and the ratio of guanine to cytosine, are always very close to unity for deoxyribose nucleic acid.

It is probably impossible to build this structure with a ribose sugar in place of the deoxyribose, as the extra oxygen atom would make too close a van der Waals contact.

The previously published X-ray data^{5,6} on deoxyribose nucleic acid are insufficient for a rigorous test of our structure. So far as we can tell, it is roughly compatible with the experimental data, but it must be regarded as unproved until it has been checked against more exact results. Some of these are given in the following communications. We were not aware of the details of the results presented there when we devised our structure, which rests mainly though not entirely on published experimental data and stereochemical arguments.

It has not escaped our notice that the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material.

Full details of the structure, including the conditions assumed in building it, together with a set of co-ordinates for the atoms, will be published elsewhere.

We are much indebted to Dr. Jerry Donohue for constant advice and criticism, especially on interatomic distances. We have also been stimulated by a knowledge of the general nature of the unpublished experimental results and ideas of Dr. M. H. F. Wilkins, Dr. R. E. Franklin and their co-workers at King's College, London. One of us (J. D. W.) has been aided by a fellowship from the National Foundation for Infantile Paralysis.

J. D. WATSON
F. H. C. CRICK

Medical Research Council Unit for the
Study of the Molecular Structure of
Biological Systems,
Cavendish Laboratory, Cambridge.
April 2.

¹ Pauling, L., and Corey, R. B., *Nature*, **171**, 346 (1953); *Proc. U.S. Nat. Acad. Sci.*, **39**, 84 (1953).

² Furberg, S., *Acta Chem. Scand.*, **6**, 634 (1952).

³ Chargaff, E., for references see Zamenhof, S., Brawerman, G., and Chargaff, E., *Biochim. et Biophys. Acta*, **9**, 402 (1952).

⁴ Wyatt, G. R., *J. Gen. Physiol.*, **36**, 201 (1952).

⁵ Astbury, W. T., *Symp. Soc. Exp. Biol.*, **1**, Nucleic Acid, 66 (Camb. Univ. Press, 1947).

⁶ Wilkins, M. H. F., and Randall, J. T., *Biochim. et Biophys. Acta*, **10**, 192 (1953).

Exhibit 2-C. Proofreader's Symbols
(from DoC handbook of publishing and printing)

PROOFREADER MARKS

Corrections in Text

	Delete or take out
	Caret; something to be inserted
	Reel
	Copy omitted (encircle copy omitted; mark it "set" and return with proof to printer)
	Let it stand
	Encirclement means to change: Spelling to figures; figures to spelling; or spell out, as in abbreviations, signs, and symbols
	Use diphthong
	Superior or inferior (letter or figure)
	Asterisk
	Diagonal
	Indicate unusual characters by marking above

Punctuation

	Period
	Comma
	Hyphen
	Colon
	Semicolon
	Apostrophe
	Question mark (or query, when encircled)

Exclamation point

Quotations

Em dash

En dash (used to join figures, or letters and figures)

Parentheses

Brackets

Style and Type

	Lowercase
	Capital
	Capitals and lowercase
	Small capitals
	Capitals and small capitals
	Wrong font (a character of wrong face or size of type)
	Roman
	Italic
	Boldface (mark case number or kind and size of display type on proofs)
	Lightface
	Paragraph
	No paragraph—set flush or run in

Space and Position

	Close up
	Flush left or right as indicated

Exhibit 2-C. Proofreader's Symbols—Continued

↗	Move to right	2/1/1/ #	Delete and close up, or delete and leave space (important to use when deleting hyphen to indicate whenever the correction is one word or two words)
↖	Move to left		
↕	Move up or down	1/ #	Delete Space
<i>ctr or cr</i>	Center	□	Indent or use 1-em space
<i>tr</i>	Transpose; change position (letters, words, paragraphs, etc.)	□□	Indent or use 2-em space, or the number of squares shown
#	Space; a normal space between words; a line space between lines (or indicate the space wanted: 2-pt. #, 10-pt. #, etc.)	<i>leaded</i>	Generally means 2-point additional space between lines
✓	Less Space	<i>solid</i>	No extra space between lines
<i>lg</i> #	Equal space between words	<i>ld</i> 7	Insert lead
<i>=</i> //	Aline words or figures (vertically or horizontally)	<i>1/ ld</i>	Take out lead
	34 56 75	<i>tr over</i>	Run over to next line
		<i>tr up</i>	Run up to line above
		<i>ok w/c for press</i> 10-7-57 RP	OK with corrections; show next action; initial and date when returned to printer

Exhibit 2-D. NBS Guidelines for the Use of the International System of Units (SI)

REPRINTED FROM
December 1979 DIMENSIONS/NBS
(with revised Appendix 3, August 1980)

LC 1120

Guidelines for Use of the MODERNIZED METRIC SYSTEM

Actions at the 1979 General Conference on Weights and Measures (CGPM)*

Since the last publication of the NBS guidelines for the use of the International System of Units (SI) in 1977, three important actions concerning SI have been taken by the General Conference on Weights and Measures. This revised version of the NBS guidelines reflects these decisions.

At their meeting in Paris, France, October 8-12, 1979, the General Conference:

- (1) Redefined the base SI unit candela to read—
The candela is the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540×10^{12} hertz and of which the radiant intensity in that direction is 1/683 watt per steradian.
- (2) Adopted the special name sievert, symbol Sv, for the SI unit of dose equivalent in the field of radiological protection. The sievert is equal to one joule per kilogram.
- (3) Adopted l and L as alternative symbols for the unit liter.



Ernest Ambler
Director

* E. Ambler was the U.S. delegate to the CGPM, accompanied by advisors Francis X. Cunningham (Department of State), Edward L. Brady (NBS), and Abraham S. Friedman (American Embassy, Paris).

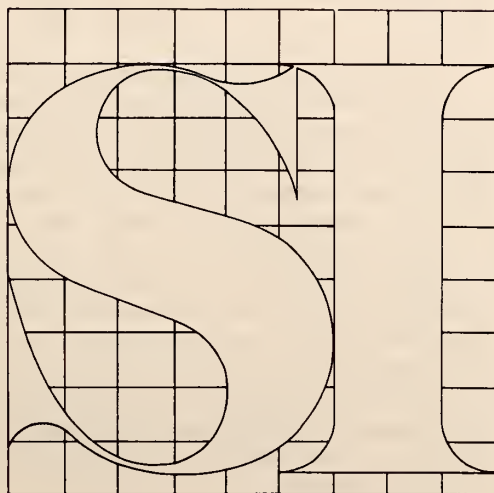
The International System of Units

THE following Guidelines have been adopted by the National Bureau of Standards of the U.S. Department of Commerce for use of the International System of Units (SI),¹ informally called the metric system.

These Guidelines² reflect the decisions of the General Conference on Weights and Measures (CGPM) and its subordinate Committees which defined the modernized metric system and gave offi-

¹ The International System of Units (SI) was initially defined and given official status by the 11th General Conference on Weights and Measures, 1960. A complete listing of the SI units is presented in NBS Special Publication 330, 1977 Edition. A summary of the SI is given in Appendix 1 of this document.

² These Guidelines supersede LC 1056 dated November 1977 and those that appeared in DIMENSIONS/NBS, October 1977.



cial status to SI in 1960. The United States holds a place on these international bodies by virtue of its adherence to the Treaty of the Meter, signed in 1875. The National Bureau of Standards acts as the official U.S. representative to the various international bodies formed by the Treaty.

The National Bureau of Standards, in light of the Metric Conversion Act of 1975, recommends the use of metric units except in contexts where the exclusive use of metric units would needlessly confuse the intended audience. In these cases, the dual use of metric and inch-pound (customary) units may serve the two purposes of not only communicating the contents but also familiarizing the readers with the new metric system.

In all cases, NBS recommends a common-sense approach to metric conversion. These Guidelines are meant to provide NBS recommendations on the use of the modernized metric system while recognizing the evolving nature of metric practice in the U.S.

For further information concerning metric conversion in the United States, the reader should contact the U.S. Metric Board, 1815 N. Lynn Street, Suite 600, Arlington, VA 22209. For further information about the metric system, contact the NBS Office of Technical Publications, Washington, D C 20234.

The Metric System: SI

The SI is constructed from seven base units for independent quantities plus two supplementary units for plane angle and solid angle. (See table 1). Units for all other quantities are derived from these nine units. In table 2 are listed 19 SI derived units with special names. These units are derived from the base and supplementary units in a coherent manner, which means they are expressed as products and quotients of the nine base and supplementary units without numerical factors. All other SI derived units, such as those in tables 3 and 4, are similarly derived in a coherent manner from the 28 base, supplementary, and special-name SI units. For use with the SI units, there is a set of 16 prefixes (see table 5) to form multiples and submultiples of these units. For mass, the prefixes are to be applied to the gram instead of to the SI base unit, the kilogram.

The SI units together with the SI prefixes provide a logical and interconnected framework for measurements in science, industry, and commerce. NBS encourages the use of SI in the United States.

Fundamental Constants/Natural Units

In some cases, quantities are commonly expressed in terms of fundamental constants of nature, and use of these constants or "natural units" is acceptable. The author, however, should state clearly which natural units are being used; such broad terms as "atomic units" should be avoided when there is danger of confusion.

Typical examples of natural units are:

Unit	Symbol
elementary charge	e
electron mass	m_e
proton mass	m_p
Bohr radius	a_0
electron radius	r_e
Compton wavelength of electron	λ_C
Bohr magneton	μ_B
nuclear magneton	μ_N
speed of light	c
Planck constant	h

Units Acceptable for Use with SI

Certain units which are not part of the SI are used so widely that it is impractical to abandon them. The units that are accepted for continued use with the International System are listed in table 6. It is likewise necessary to recognize, outside the International System, the following units which are used in specialized fields:

Unit	Symbol
electron volt	eV
unified atomic mass unit	u
astronomical unit	AU
parsec	pc

The units shown with an asterisk in table 7 are used in limited fields and have been authorized by the International Committee for Weights and Measures (CIPM), the international committee that guides the technical work of the Treaty of the Meter, for temporary use in those fields.

The short names for compound units (such as "coulomb" for "ampere second" and "pascal" for "newton per square meter") exist for convenience, and either form is correct (see table 2). For example, communication sometimes is facilitated if the author expresses magnetic flux in the compound term volt seconds (instead of using the synonym, webers) because of the descriptive value implicit in the compound phrase.

Special Considerations

The kelvin (K) is the SI base unit of temperature; this unit is properly used for expressing temperature and temperature intervals. However, wide use is also made of the degree Celsius ($^{\circ}\text{C}$) for expressing temperature and temperature intervals. The Celsius scale (formerly called centigrade) is related directly to thermodynamic temperature (kelvins) as follows:

The temperature interval one degree Celsius equals one kelvin exactly.

Celsius temperature (t) is related to thermodynamic temperature (T) by the equation:

$$t = T - T_0$$

where $T_0 = 273.15 \text{ K}$ by definition.

Words and symbols should not be mixed. If mathematical operations are indicated, for example, only symbols should be used. Any of the forms "joules per mole," "J/mol," "J·mol⁻¹" is considered good usage, but the forms "joules/mole" and "joules·mol⁻¹" are not. See Appendix 2 for additional rules.

Logarithmic measures such as pH, dB (decibel), and Np (neper) are acceptable.

Over the years the term *weight* has been used to designate two quantities: *mass* and *force*. NBS generally supports the recommendation in the American National Standard for Metric Practice (Z 210.1-1976), that the term *weight* should be avoided except under circumstances in which its

meaning is completely clear. (For further discussion, see Appendix 3.)

It is also recommended that the terms *atomic weight* and *molecular weight* be replaced by *relative atomic mass* and *relative molecular mass* in accordance with established international practice.³

Descriptive and Essential Data

Descriptive data describe arrangements, environments, noncritical dimensions and shapes of apparatus, and similar measurements not affecting calculations or results. Such data should be expressed in SI units unless this makes the expression excessively complicated. For example, commercial gauge designations, commonly used items identified by nominal dimensions, or other commercial nomenclatures (such as drill sizes, or standards for weights and measures) expressed in inch-pound units are acceptable.

Essential data express or interpret the quantitative results being reported. All such data shall be expressed solely in SI units except in those fields where (a) the sole use of SI units would create a serious impediment to communications, or (b) SI units have not been specified. Exceptions may also occur when dealing with commercial devices, standards, or units having some legal definition, such as commercial weights and measures. Even in such instances, SI units should be used when practical and meaningful; for example, this may be done by adding non-SI units in parentheses after SI units. In tables, SI and inch-pound units may be shown in parallel columns. If coordinate markings in non-SI units are included in graphs, they should be displayed on the top and right-hand sides of the figure.

Additional References

For additional information on the use of SI units, the reader is directed to the following publications:

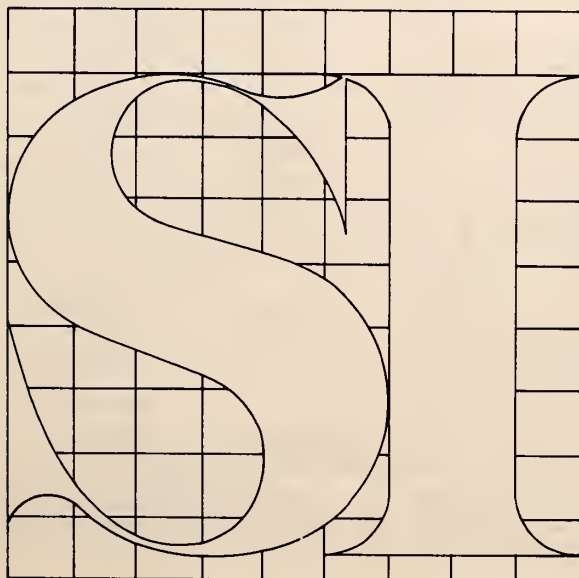
NBS SP 330, 1977 Edition, "The International System of Units: SI," the translation of the official text, "Le Système International d'Unités," (1977).

ISO International Standard 1000 (1973 Edition) "SI Units and Recommendations for Use of Their Multiples."

American National Standard Z210.1-1976, American Standard for Metric Practice.

Examples of conversion factors from non-SI units to SI are provided in table 7.

³ ISO 31/VIII "Quantities and Units of Physical Chemistry and Molecular Physics."



**APPENDIX 1
Units and
Conversion
Factors**

TABLE 1. SI base and supplementary units

	Quantity*	Unit Name	Unit Symbol
SI base units	length	meter	m
	mass ¹	kilogram	kg
	time	second	s
	electric current	ampere	A
	thermodynamic temperature	kelvin	K
	amount of substance	mole	mol
	luminous intensity	candela	cd
SI supplementary units	plane angle	radian	rad
	solid angle	steradian	sr

¹ See Appendix 3 for a discussion of the terms "mass" and "weight."

* Quantity here and in Tables 2, 3, 4, and 7 means a measurable attribute.

TABLE 2. SI derived units with special names

Quantity	SI Unit			
	Name	Symbol	Expression in terms of other units	Expression in terms of SI base units
frequency	hertz	Hz		s ⁻¹
force	newton	N		m·kg·s ⁻²
pressure, stress	pascal	Pa	N/m ²	m ⁻¹ ·kg·s ⁻²
energy, work, quantity of heat	joule	J	N·m	m ² ·kg·s ⁻²
power, radiant flux	watt	W	J/s	m ² ·kg·s ⁻³
quantity of electricity, electric charge	coulomb	C	A·s	s·A
electric potential, potential difference, electromotive force	volt	V	W/A	m ² ·kg·s ⁻³ ·A ⁻¹
capacitance	farad	F	C/V	m ⁻² ·kg ⁻¹ ·s ⁴ ·A ²
electric resistance	ohm	Ω	V/A	m ² ·kg·s ⁻³ ·A ⁻²
conductance	siemens	S	A/V	m ⁻² ·kg ⁻¹ ·s ³ ·A ²
magnetic flux	weber	Wb	V·s	m ² ·kg·s ⁻² ·A ⁻¹
magnetic flux density	tesla	T	Wb/m ²	kg·s ⁻² ·A ⁻¹
inductance	henry	H	Wb/A	m ² ·kg·s ⁻² ·A ⁻²
Celsius temperature ^(a)	degree Celsius	°C		K
luminous flux	lumen	lm		cd·sr ^(b)
illuminance	lux	lx	lm/m ²	m ⁻² ·cd·sr ^(b)
activity (of a radionuclide)	becquerel	Bq		s ⁻¹
absorbed dose, specific energy imparted, kerma, absorbed dose index	gray	Gy	J/kg	m ² ·s ⁻²
dose equivalent, dose equivalent index	sievert	Sv	J/kg	m ² ·s ⁻²

^(a) See Special Considerations, p.15.

^(b) In this expression the steradian (sr) is treated as a base unit.

TABLE 3. Some SI derived units expressed in terms of base units

Quantity	SI Unit	Unit Symbol
area	square meter	m ²
volume	cubic meter	m ³
speed, velocity	meter per second	m/s
acceleration	meter per second squared	m/s ²
wave number	1 per meter	m ⁻¹
density, mass density	kilogram per cubic meter	kg/m ³
current density	ampere per square meter	A/m ²
magnetic field strength	ampere per meter	A/m
concentration (of amount of substance)	mole per cubic meter	mol/m ³
specific volume	cubic meter per kilogram	m ³ /kg
luminance	candela per square meter	cd/m ²

TABLE 4. Some SI derived units expressed by means of special names

Quantity	SI Unit		Expression in terms of SI base units
	Name	Symbol	
dynamic viscosity	pascal second	Pa·s	m ⁻¹ ·kg·s ⁻¹
moment of force	newton meter	N·m	m ² ·kg·s ⁻²
surface tension	newton per meter	N/m	kg·s ⁻²
power density, heat flux density, irradiance	watt per square meter	W/m ²	kg·s ⁻³
heat capacity, entropy	joule per kelvin	J/K	m ² ·kg·s ⁻² ·K ⁻¹
specific heat capacity, specific entropy	joule per kilogram kelvin	J/(kg·K)	m ² ·s ⁻² ·K ⁻¹
specific energy	joule per kilogram	J/kg	m ² ·s ⁻²
thermal conductivity	watt per meter kelvin	W/(m·K)	m·kg·s ⁻³ ·K ⁻¹
energy density	joule per cubic meter	J/m ³	m ⁻¹ ·kg·s ⁻²
electric field strength	volt per meter	V/m	m·kg·s ⁻³ ·A ⁻¹
electric charge density	coulomb per cubic meter	C/m ³	m ⁻³ ·s·A
electric flux density	coulomb per square meter	C/m ²	m ⁻² ·s·A
permittivity	farad per meter	F/m	m ⁻³ ·kg ⁻¹ ·s ⁴ ·A ²
permeability	henry per meter	H/m	m·kg·s ⁻² ·A ⁻²
molar energy	joule per mole	J/mol	m ² ·kg·s ⁻² ·mol ⁻¹
molar entropy, molar heat capacity	joule per mole kelvin	J/(mol·K)	m ² ·kg·s ⁻² ·K ⁻¹ ·mol ⁻¹
exposure (x and γ rays)	coulomb per kilogram	C/kg	kg ⁻¹ ·s·A
absorbed dose rate	gray per second	Gy/s	m ² ·s ⁻³

TABLE 5. SI prefixes

Factor	Prefix Symbol	Factor	Prefix Symbol
10^{18}	exa E	10^{-1}	deci d
10^{15}	peta P	10^{-2}	centi c
10^{12}	tera T	10^{-3}	milli m
10^9	giga G	10^{-6}	micro μ
10^6	mega M	10^{-9}	nano n
10^3	kilo k	10^{-12}	pico p
10^2	hecto h	10^{-15}	femto f
10^1	deka da	10^{-18}	atto a

TABLE 6. Units in use with the International System

Name	Symbol	Value in SI Unit
minute	min	1 min = 60 s
hour	h	1 h = 60 min = 3 600 s
day	d	1 d = 24 h = 86 400 s
degree	$^{\circ}$	$1^{\circ} = (\pi/180) \text{ rad}$
minute	'	$1' = (1/60)^{\circ} = (\pi/10\,800) \text{ rad}$
second	"	$1'' = (1/60)' = (\pi/648\,000) \text{ rad}$
liter	L*	1 L = $1 \text{ dm}^3 = 10^{-3} \text{ m}^3$
metric ton	t	1 t = 10^3 kg
hectare	ha	1 ha = 10^4 m^2

* An alternative symbol for liter is "l". Since "l" can be easily confused with the numeral "1," the symbol "L" is recommended for United States use.

TABLE 7. Examples of conversion factors from non-SI units to SI

Quantity	Name of Unit	Symbol for Unit	Definition in SI Units
length	inch	in	$2.54 \times 10^{-2} \text{ m}$
length	nautical mile*	nmi	1852 m
length	# angstrom*	\AA	10^{-10} m
velocity	knot*	kn	$(1852/3600) \text{ m/s}$
cross section	barn*	b	10^{-28} m^2
acceleration	# gal*	Gal	10^{-2} m/s^2
mass	pound (avoirdupois)	lb	0.453 592 37 kg
force	kilogram-force	kgf	9.806 65 N
pressure	millimeter of mercury at 0°C	mmHg	133.322 Pa†
pressure	atmosphere	atm	101 325 Pa
pressure	torr	Torr	$(101\,325/760) \text{ Pa}$
pressure	# bar*	bar	10^5 Pa
stress	pound-force per sq in	lbf/in ²	6 894.757 Pa†
energy	British thermal unit (Int. Table)	Btu	1055.056 J†
energy	kilowatt hour	kWh	$3.6 \times 10^6 \text{ J}$
energy	calorie (thermochemical)	cal	4.184 J
activity (of a radionuclide)	curie*	Ci	$3.7 \times 10^{10} \text{ Bq}$
exposure (x or γ rays)	roentgen*	R	$2.58 \times 10^{-4} \text{ C}\cdot\text{kg}^{-1}$
absorbed dose	rad*	rd	$1 \times 10^{-2} \text{ Gy}$
dose equivalent	rem*	rem	$1 \times 10^{-2} \text{ Sv}$

* The CIPM has sanctioned the temporary use of these units.

† Approximate; all other conversion factors are exact.

#The use of these units is discouraged in the American National Standard for Metric Practice, Z210.1

APPENDIX 2

Writing Style Guides

1. CAPITALS

Units: When written in full, the names of all units start with a lowercase letter, except at the beginning of a sentence or in capitalized material such as a title. Note that in degree Celsius the unit "degree" is lowercase but the modifier "Celsius" is capitalized. The "degree centigrade" is obsolete.

Symbols: Unit symbols are written with lowercase letters except that (1) the first letter is uppercase when the name of the unit is derived from the name of a person and (2) the symbol for liter is capital L.

Prefixes: The symbols for numerical prefixes for exa(E), peta(P), tera(T), giga(G), and mega(M) are written with uppercase letters, all others with lowercase letters. All prefixes are written in lowercase letters when written out in full, except where the entire unit name is written in uppercase letters.

2. PLURALS

a. When written in full, the names of units are made plural when appropriate. Fractions both common and decimal are always singular.

b. Symbols for units are the same in singular and plural (no "s" is ever added to indicate a plural).

3. PERIODS

A period is NOT used after a symbol, except at the end of a sentence.

4. THE DECIMAL MARKER

The dot (point) is used as the decimal marker and is placed on the line. In numbers less than one, a zero must be written before the decimal point.

5. GROUPING OF DIGITS

a. Digits should be separated into groups of three, counting from the decimal marker. The comma should not be used. Instead, a space is left to avoid confusion, since many countries use a comma for the decimal marker.

b. In numbers of four digits, the space is not recommended, unless four-digit numbers are grouped in a column with numbers of five digits or more.

6. SPACING

a. In symbols or names for units that have prefixes, no space is left between letters making up the symbol or the name.

b. When a symbol follows a number to which it refers, a space must be left between the number and the symbol (except for degree, minute, and second of angle).

7. COMPOUND UNITS

In the symbol for a compound unit that is formed by the multiplication of two or more units, a centered dot is used. For example, N·m.

In the name of such a unit, a space is recommended (or a hyphen is permissible) but never a centered dot. For example, newton meter or newton-meter.

APPENDIX 3

Recommended Use of Mass and Weight

There is no explicit SI unit for *weight* but the word is in very common use. Ambiguity exists in the use of the term *weight* as a quantity to mean either force or mass. In commercial and everyday use, the term *weight* usually refers to amount of matter; thus, when one speaks of a person's *weight*, the quantity referred to is that designated as mass in science and technology, for which the SI unit is the kilogram.

In science and technology, the term *weight* of a body usually means the force that, if applied to the body, would give it an acceleration equal to the local acceleration of free fall. The adjective *local* in the phrase *local acceleration of free fall* usually means a location on the surface of the earth, but may be extended to other locations such as the moon. The designation *free fall* refers to motion in vacuum thus eliminating air resistance and buoyancy effects. In this context the *local acceleration of free fall* has the symbol *g* (sometimes referred to as *acceleration of gravity*) with observed values of *g* differing by over 0.5% at various points on the earth's surface and having an internationally accepted assigned standard value of 9.806 65 m·s⁻² (CGPM (1901)). It is recommended that one use the term *force of gravity* instead of using the term *weight*, when force of gravity is intended. If, however, one chooses to use the term *weight* to mean *force of gravity*, this should be explicitly stated. It is further recommended that in publications and other communications intended primarily for technical audiences, when one means mass one should use the term *mass* and avoid the term *weight*, though it must be recognized that in certain technical fields *weight* has been used as a synonym for *mass*.

The dual use of the term *weight* will probably persist in everyday life. Therefore, when the term is used under ordinary circumstances, it is important to differentiate between mass and force by using SI units properly; i.e., by using kilograms for mass and newtons for force.

Exhibit 2-E. Expression of the Uncertainties of Final Results

EXPRESSIONS OF IMPRECISION, SYSTEMATIC ERROR, AND UNCERTAINTY ASSOCIATED WITH A REPORTED VALUE

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(Reprinted in part from NBS Publication 300, Volume 1, February 1969.)

The work of a calibration laboratory may be thought of as a sequence of operations that result in the collection, storage, and transmittal of information. In making a statement of uncertainty of the result of calibration, the calibration laboratory transmits information to its clients on the particular item calibrated.

It is logical, then, to require the transmitted information to be meaningful and unambiguous, and to contain all the relevant information in the possession of the laboratory. *The information content of the statement of uncertainty determines, to a large extent, the worth of the calibrated value.*

A common deficiency in many statements of uncertainty is that they do not convey all the information a calibration laboratory has to offer, information acquired through much ingenuity and hard work. This deficiency usually originates in two ways:

1. Loss of information through oversimplification, and
2. loss of information through the inability of the laboratory to take into account information accumulated from its past experience.

With the increasingly stringent demands for improved precision and accuracy of calibration work, calibration laboratories as a whole just cannot afford such luxury.

Traceability to the national standards, accuracy ratios, and class tolerance requirements are simplified concepts that aim to achieve different degrees of accuracy requirements. These concepts and the result-

ing statements are useful on certain occasions, but fail whenever the demand is exacting. The general practice of obliterating all the identifiable components of uncertainty, by combining them into an overall uncertainty, just for the sake of simplicity, is another case in point. After all, if the calibration laboratory reports all the pertinent information in separate components, the user can always combine them or use them individually, as he sees fit. On the other hand, if the user is given only one number, he can never disentangle this number into its various components. Since the information buried under these oversimplified statements is available, and may well be useful to sophisticated customers, such practices result in substantial waste of effort and resources.

In calibrating an item by repeating the same calibration procedure, the calibration laboratory gains increments of information about its calibration *system*. These increments of information are quantified and accumulated for the benefit of the calibration laboratory. If the precision of the calibration process remains unchanged, the statistical measure of dispersion (s) – i.e., the standard deviations computed from these sets of data – can be pooled together, weighted by their respective degrees of freedom. When many such increments of information are combined, an accepted or canonical value of standard deviation (σ) is established. This established (canonical) value of standard deviation characterizes the precision of the calibration process, and is treasured information in any calibration laboratory.

Hence, the canonical value of standard deviation is the quantification of information accumulated from past experiences of the calibration laboratory, and is an essential element of the statement of uncertainty. The standard deviation (s) computed from the current calibration is used to check the precision of current work, and to add to the pool of information on the process, but certainly does not represent all the information available in the possession of an established calibration laboratory. Only by passing its accumulated information to the users is the calibration laboratory performing a complete service.

STATEMENT OF UNCERTAINTY

In the preparation of a statement of uncertainty, it is helpful to bear in mind that:

1. The derivation of a statement of uncertainty has as its foundation the work done in the laboratory, and is based on information accumulated from past experience, and
2. In general, information is lost through oversimplification, and demands for improved precision and accuracy cannot be met with simplified statements of uncertainty.

Unless a statement of uncertainty is well formulated and supported, it is difficult to say what is meant by the statement, a difficulty frequently encountered. Since the evaluation of uncertainty is part and parcel of the high standard of work of a calibration laboratory, the statement of uncer-

tainty deserves all the attention required to make the statement both realistic and useful. To this end, Tables 1, 2 and 3 give terms and expressions compiled as a ready reference for those who are searching for some appropriate format or wording, to carry out the thoughts expressed. They summarize the recommended practices on expression of uncertainties as given in Chapter 23 of NBS Handbook 91. A revised version of this chapter with the title "Expression of Uncertainties of Final Results" by Churchill Eisenhart may be found in NBS Special Publication 300-1. Figure 1 gives a condensed summary of this material. Tables 1, 2, and 3 give details of forms of imprecision, systematic error, and uncertainty statements.

TABLE 1 - IMPRECISION STATEMENTS

Value reported	Index or Measure of Error	Remarks
Precision of a measurement (calibration) process	(a). Standard deviation (σ) of a single determination (observation)	σ (or s with the associated degrees of freedom ¹) is of main interest as an index of precision of the measurement process. If the average of n such measurements is also reported, see (b) below.
Arithmetic mean (\bar{x}_n) of n numbers	(b). Standard error (σ/\sqrt{n}) of the reported value	\bar{x}_n is of main interest; the number n is also essential information; σ assumed known. ¹
	(c). 2 sigma limits (d). 3 sigma limits	Commonly used bounds of imprecisions; usually used when σ known, or when n large.
	(e). Confidence interval (indicate one- or two-sided)	Data points assumed to be normally distributed; report confidence coefficient (level) $100(1 - \alpha)\%$. ²
	(f). Half-width of confidence interval (or confidence limits)	Same as (e) above; for symmetrical two-sided intervals; an index to bounds of imprecision. ²
	(g). Probable error of the reported value	Probable error = $.6745 \frac{\sigma}{\sqrt{n}}$ for normally distributed data points when σ known. Use of σ/\sqrt{n} preferred. Incorrect if σ not known.
	(h). Mean deviation, or average deviation, of a measurement from the mean calculated from the sample	Limiting mean of mean deviation = $\sqrt{\frac{2}{\pi}} \sqrt{\frac{n-1}{n}} \cdot \sigma$ for normally distributed data points when σ known. Use of σ usually preferred.
	(i). Any of the above expressed in percent, or ppm of \bar{x}_n .	State what is being expressed in percent, eg., $(\sigma/\sqrt{n})(100/\bar{x}_n)$, \bar{x}_n being a fairly constant value.
m means each computed from n measurements	(j). (b), (c), (d) and (f) above	If the measurements are of equal precision and σ unknown, use $s_p^2 = \frac{1}{m} \sum_{i=1}^m s_i^2$ as estimate of σ^2 . The no. of degrees of freedom associated with s_p is $m(n-1)$.
	(k). Sample coefficient of variation ($v = \frac{s}{\bar{x}_n}$) or relative percent ($v \times 100$)	Appropriate when the m means cover a wide range and where the v 's computed for the m sets are about the same magnitude. Give range of v 's for the m sets. The means must be positive and bounded away from zero.
Weighted mean $\bar{\bar{x}} = \frac{w_1 \bar{x}_1 + w_2 \bar{x}_2}{w_1 + w_2}$	(l). Standard error ($\sigma_{\bar{\bar{x}}}^2$) of the weighted mean	If $w_1 = 1/\sigma_{\bar{x}_1}^2$ and $w_2 = 1/\sigma_{\bar{x}_2}^2$, then $\sigma_{\bar{\bar{x}}}^2 = \frac{1}{w_1 + w_2}$ Not recommended when the σ 's are not known and are estimated by s computed from small number of measurements.
An equation (theoretical or empirical) fitted to data points by the method of least squares	(m). Standard deviation computed from the deviations (residuals) of data points from the fitted curve	Report n , the number of data points, and k , the number of constants fitted, $s^2 = \frac{\sum_{i=1}^n (y_i - \hat{y}_i)^2}{(n-k)},$ where \hat{y}_i is the value on the fitted curve for the particular x_i . ³ Value of s usually given in computer print-out.
Constants (coefficients) in the equation fitted to the data points by the method of least squares	(n). Standard errors of the coefficients based on the standard deviation computed under (m)	Standard errors usually given in computer print-out. Report n and k as above. ³

TABLE 1 - IMPRECISION STATEMENTS - (Continued)

Value reported	Index or Measure of Error	Remarks
A predicted point on the curve \hat{y} for a particular x_0	(o). Standard error ($s_{\hat{y}}$) of the predicted point	For the straight line case, the computer print-out gives the variance-covariance matrix $\begin{pmatrix} s_{11} & s_{12} \\ s_{12} & s_{22} \end{pmatrix}$. $s_{\hat{y}}^2 = s_{11} + 2s_{12}x_0 + s_{22}x_0^2$. ³ Report n and k.
A predicted observed value for a particular x_0	(p). Standard error of the predicted value of y	For the straight line case, $s_y^2 = s_{\hat{y}}^2 + s^2$ where $s_{\hat{y}}^2$ and s^2 are that given in (a) and (m) respectively. ³ Report n and k
Value of function of the arithmetic means of several measured variables	(q). Standard error calculated by the use of propagation of error formulas	Appropriate when errors of measurements are small compared to the values of variables measured. Use standard error of the means of the variables in the formulas. ⁴ Report number of measurements from which these standard errors are computed.
Percentage or proportion (r/n), r and n being counts	(r). Confidence limits of the true proportion P	Procedures for obtaining exact and approximate confidence limits are discussed in Chapter 7, NBS Handbook 91. State one-sided or two-sided.

TABLE 2 - SYSTEMATIC ERROR⁵ (BIAS) STATEMENTS

Value reported	Index or Measure of Error	Remarks
Numerical value resulting from a measurement process	Reasonable bounds ascribed to the value originating from: (i). systematic error reliably established	Detailed discussions of systematic errors are always helpful. Positive wording is appropriate: "... is not in error by more than ..." "... is accurate within \pm ..."
	(ii). systematic error estimated from experience or by judgment	Use modifier such as "believed", "estimated", "considered", to signify the conjectural nature of the statement.
	(iii). combination of a number of elemental systematic errors	State explicitly the method of combination such as "the simple sum of the bounds" or "the square root of the sum of squares".
	(iv). uncertainty in same fundamental constant	Give reference to the value of constant used.
	(v). uncertainty in calibrated values	Ascertain the meaning of the systematic and random components of the uncertainty from the calibration laboratory so that decisions on the uses of these components can be made from the correct interpretations.
	(vi). bias in the method of computation	Correct if feasible, or give the magnitude.

TABLE 3 - UNCERTAINTY STATEMENTS

Value reported	Index or Measure of error	Remarks
Numerical value resulting from a measurement process	Baunds to inaccuracy: (1). Systematic error and imprecision both negligible	Explicit expression of correctness to the last significant figure, interpreted as being accurate within $\pm 1/2$ units in the last significant figure given.
	(2). Imprecision negligible. Baunds on inaccuracy given to no more than two significant figures.	Sentence form preferred such as given under remark for (i) and (ii). Footnote needed if baunds are given in tabular form.
	(3). Systematic error negligible. Index of precision (b), (g), (h), (i), (k), or (n) stated to no more than two significant figures	State explicitly the index used and give essential information associated with the index. Qualify index calculated by the word "computed". Avoid using expressions of the form $a \pm b$ unless the meaning of b is explained fully immediately following or in footnote.
	(3'). Systematic error negligible. Baunds to imprecision (c), (d), (e), or (f) stated to no more than two significant figures.	Same as under (3).
	(4). Neither systematic error nor imprecision negligible. Two numerics indicating baunds to systematic error and index of imprecision respectively	(2) and (3) above separately stated.
	(4'). Baunds to systematic error and imprecision combined, indicating the likely inaccuracy of the value	(2) and (3') above where the two components either have been previously described, or explained immediately following (or in footnote).
	(5). Quoted from literature	State reference and give author's interpretation of the uncertainty; add remark if meaning unknown or ambiguous.

¹ If σ is not known, use the computed standard deviation s based on k measurements as an estimate of σ , where

$$s^2 = \frac{1}{k-1} \sum_{i=1}^k (x_i - \bar{x})^2. \quad \text{The number } (k-1) \text{ is the degrees of freedom associated with } s.$$

² For interpretation see Chapter 1, NBS Handbook 91, *Experimental Statistics*, by M. G. Natrella, 1963.

³ For details see Chapter 5 (straight line), and Chapter 6 (multivariate and polynomial), NBS Handbook 91.

⁴ For details see "Notes on the use of propagation of error formulas", by Harry H. Ku, NBS Journal of Research, Vol. 70C, No. 4, October-December, 1966.

⁵ See "Realistic Evaluation of the Precision and Accuracy of Instrument Calibration Systems" by Churchill Eisenhart, NBS Journal of research, Vol. 67C, No. 2, April-June, 1963, and "Systematic Errors in Physical Constants" by W. J. Yarden, Physics Today 14, 1961.

FIGURE 1 – SUMMARY OF RECOMMENDATIONS ON EXPRESSIONS OF THE UNCERTAINTIES OF FINAL RESULTS

SYSTEMATIC ERROR AND IMPRECISION BOTH NEGLIGIBLE (CASE 1)

In this case, the reported result should be given correct to the number of significant figures consistent with the accuracy requirements of the situation, together with an explicit statement of its accuracy or correctness.

SYSTEMATIC ERROR NOT NEGLIGIBLE, IMPRECISION NEGLIGIBLE (CASE 2)

(a) Qualification of a reported result should be limited to a single quasi-absolute type of statement that places bounds on its inaccuracy;

(b) These bounds should be stated to no more than two significant figures;

(c) The reported result itself should be given (i.e., rounded) to the last place affected by the stated bounds, unless it is desired to indicate and preserve such relative accuracy or precision of a higher order that the result may possess for certain particular uses;

(d) Accuracy statements should be given in sentence form in all cases, except when a number of results of different accuracies are presented, e.g., in tabular arrangement. If it is necessary or desirable to indicate the respective accuracies of a number of results, the results should be given in the form $a \pm b$ (or $a \pm \frac{b}{c}$, if necessary) with an appropriate explanatory remark (as a footnote to the table, or incorporated in the accompanying text) to the effect that the $\pm b$, or $\pm \frac{b}{c}$, signify bounds to the errors which the a 's may be subject.

(e) The fact that the imprecision is negligible should be stated explicitly.

NEITHER SYSTEMATIC ERROR NOR IMPRECISION NEGLIGIBLE (CASE 3)

(a) A reported result should be qualified by: (1) a quasi-absolute type of statement that places bounds on its systematic error; and, (2) a separate statement of its standard error or of an upper bound thereto, whenever a reliable determination of such value or bound is available — otherwise, a computed value of the standard error so designated should be given, together with a statement of a number of degrees of freedom on which it is based;

(b) The bounds to its systematic error and the measure of its imprecision should be stated to no more than two significant figures;

(c) The reported result itself should be stated, at most, to the last place affected by the finer of the two qualifying statements, unless it is desired to indicate and preserve such relative accuracy or precision of a higher order that the result may possess for certain particular uses;

(d) The qualification of a reported result, with respect to its imprecision and systematic error, should be given in sentence form, except when results of different precision or with different bounds to their systematic errors are presented in tabular arrangement. If it is necessary or desirable to indicate their respective imprecisions or bounds to their respective systematic errors, such information may be given in a parallel column or columns, with appropriate identification.

SYSTEMATIC ERROR NEGLIGIBLE, IMPRECISION NOT NEGLIGIBLE (CASE 4)

(a) Qualification of a reported value should be limited to a statement of its standard error or of an upper bound thereto, whenever a reliable determination of such value or bound is available. Otherwise, a computed value of the standard error so designated should be given, together with a statement of the number of degrees of freedom on which it is based;

(b) The standard error, or upper bound thereto, should be stated to not more than two significant figures;

(c) The reported result itself should be stated, at most, to the last place affected by the stated value or bound to its imprecision, unless it is desired to indicate and preserve such relative precision of a higher order that the result may possess for certain particular uses;

(d) The qualification of a reported result with respect to its imprecision should be given in sentence form, except when results of different precision are presented in tabular arrangement and it is necessary or desirable to indicate their respective imprecisions, in which event such information may be given in a parallel column or columns, with appropriate identification.

(e) The fact that the systematic error is negligible should be stated explicitly.

POSTSCRIPT

Over the intervening years since the publication of Eisenhart's and Ku's articles, it has become apparent that a few additional comments may be useful. It is equally apparent that a complete revision is neither necessary nor desirable inasmuch as the major thrust and content of the articles remain as valid and as appropriate as when first written. For this reason, these comments are made as a postscript.

Uncertainty Assessments Must Be Complete

The uncertainty of a reported value is meant to be a credible estimate of the likely limits to its actual *error*, i.e., the magnitude and sign of its deviation from the truth. As such, uncertainty statements must be based on as nearly complete an assessment as possible. This assessment process must consider every conceivable source of inaccuracy in the result.

A measurement process generally consists of a very complicated sequence of many individual unit operations or steps. Virtually every step in this sequence introduces a conceivable source of inaccuracy whose magnitude must be assessed. These sources include:

- Inherent stochastic variability of the measurement process;
- Uncertainties in standards and calibrated apparatus;
- Effects of environmental factors, such as variations in temperature, humidity, atmospheric pressure, and power supply voltage;
- Time-dependent instabilities due to gradual and subtle changes in standards or apparatus;
- Inability to realize physical model because of instrument limitations;
- Methodology procedural errors, such as incorrect logic, or misunderstanding what one is or should be doing;
- Uncertainties arising from interferences, impurities, inhomogeneity, inadequate resolution, incomplete discrimination, etc.;
- Metrologist errors, such as misreading of an instrument;
- Malfunctioning or damaged apparatus;
- Laboratory practice including handling techniques, cleanliness, etc.; and
- Computational uncertainties as well as errors in transcription of data, and other calculational or arithmetical mistakes.

This list should not be interpreted as exhaustive, but rather as illustrative of the most common generic sources of inaccuracy that may be present.

The various sources of inaccuracy are generally classified into sources of *imprecision* (random components) and sources of *bias* (fixed offsets). To which category a particular source should be properly assigned is often difficult and troublesome. In part, this is because many experimental procedures or individual steps in the overall measurement process embody both systematic and

stochastic (random) elements. (For an alternative discussion that questions the need for a clear cut distinction between random and systematic components of uncertainty, see [7].) One practical approach is to classify the sources of inaccuracy according to how the uncertainty is estimated. In this way, sources of imprecision are considered to be those components which *can be* and *are* estimated by a statistical analysis of replicate determinations. For completeness, the *systematic uncertainty components* can be considered to be the residual set of conceivable sources of inaccuracy that are biased and not subject to random variability, and those that may be due to random causes but *cannot be* or *are not* assessed by statistical methods. The systematic category includes sources of inaccuracy other than biases in order to obtain a complete accounting of all sources of inaccuracy in the measurement process. Hence, it is meaningful to report a random uncertainty contribution, only if one has a computed statistic for the magnitude of its imprecision or random variation. Many sources of inaccuracy may exist consisting of several components from both the random and systematic categories and can be assessed only after consideration of the more fundamental processes involved. The uncertainty in the calibration of an instrument with a standard reference material, for example, would have not only components from the uncertainty in the standard itself, but also uncertainty components arising from the use of the standard in performing the calibration.

Assessment of Imprecision (Random Uncertainties)

Although the treatment and expressions of reporting the imprecision of measurement results were adequately covered in the original article, a number of points are of sufficient importance to deserve reemphasis.

The only way to assess realistically the overall imprecision is to make direct—or preferably, when possible, indirect—replicate determinations [1] and calculate an appropriate statistic such as the standard error of the mean. It is extremely important to be definite on what constitutes a “replicate determination” because the extent to which conditions are allowed to vary freely over successive “repetitions” of the measurement process determines the scope of the statistical inferences that may be drawn from measurements obtained [2, sec. 4.1]. When measurements of a particular quantity made on a single occasion exhibit closer mutual agreement than measurements made on different occasions so that differences between occasions are indicated, the value of the computed standard error of the mean of all the measurements obtained by lumping all of the measurements together will underestimate the actual standard error of the mean. A more realistic value is given by taking the arithmetic means of the measurements obtained on the respective occasions as the *replicate determinations* and calculating the standard error of their mean in the usual way [3, sec. 3.5].

In many situations, it may not be possible or feasible because of time and cost constraints to perform a sufficient number of completely independent determinations of the measurement result. For results derived from several component quantities, the individual imprecision estimates must be propagated to obtain the imprecision of the final result. It must be emphasized, however, that

these estimates of imprecision should not be based exclusively on the information derived from just the present measurements. Presently derived information should be added to the information accumulated in the past on the imprecision of the measurement process. In this way, more realistic and reliable canonical values of the imprecision statistics may be established over time. Ideally, every major step or component of the measurement process should be independently assessed. This would include not only the variability inherent in the particular measurement of concern, but also the imprecision arising from corrections, calibration factors, and any other quantities that make up the final result.

Assessment of Systematic Uncertainties

Although a general guideline for the approach to the assessment of systematic uncertainties can be formulated, there are, unfortunately, no rules to objectively assign a magnitude to them. For the most part, it is a subjective process. Their magnitudes should preferably be based on experimental verification, but may have to rely on the judgment and experience of the metrologist. In general, each systematic uncertainty contribution is considered as a quasi-absolute upper bound, overall or maximum limit on its inaccuracy. Its magnitude is typically estimated in terms of an interval from plus to minus δ about the mean of the measurement result. By what method then should the magnitude of these maximum limits be assigned? It may be based on comparison to a standard, on experiments designed for the purpose [4], or on verification with two or more independent and reliable measurement methods. Additionally, the limits may be based on judgment, based on experience, based on intuition, or based on other measurements and data. Or the limits may include combinations of some or all of the above factors. Whenever possible, they should be empirically derived or verified. The reliability of the estimate of the systematic uncertainty will largely depend on the resourcefulness and ingenuity of the metrologist.

The Need for an Overall Uncertainty Statement

Without deprecating the perils of shorthand expressions, there is often a need for an overall uncertainty statement which combines the imprecision and systematic uncertainty components. Arguments that it is incorrect from a theoretical point of view to combine the individual components in any fashion are not always practical. First, an approach which retains all details is not amenable for large compilations of results from numerous sources. And second, this approach shifts the burden of evaluating the uncertainties to users. Many users need a single uncertainty value resulting from the combination of all sources of inaccuracy. These users believe, and rightly so, that this overall estimate of inaccuracy can be most appropriately made by the person responsible for the measurement result. It must be emphasized, however, that there is no one clearly superior appropriate method for reporting an overall uncertainty, and that the choice of method is somewhat arbitrary. Several methods are commonly employed [5,6].

One method is to add linearly all components of the systematic uncertainty and linearly add the total to the imprecision estimate. Since the individual systematic uncertainties (δ_j) are considered to be maximum limits, it

logically should be added to an imprecision estimate at a similar confidence level. That is, for example, the overall uncertainty u may be given by

$$u = [t_v(\alpha)]s + \sum_{j=1}^q \delta_j$$

where s is the computed standard error based on ν degrees of freedom, $t_v(\alpha)$ is the Student- t value corresponding to a two-tail significance level of $\alpha=0.05$, 0.01, or 0.001 (depending on the practice in the measurement field concerned), and δ_j is the magnitude of the estimated systematic uncertainty for each of the identified q systematic uncertainty components. This approach probably overestimates the inaccuracy, but can be considered as an estimate of the maximum possible limits. For example, if someone estimated that five contributions of about equal magnitude made up the total systematic error, that person would have to be very unlucky if all five were plus, or all five were minus. Yet, if there was one dominant contributor, it might be a very valid approximation.

Two other approaches have also been widely used. These methods add in quadrature all of the systematic uncertainty components, and either add the resulting quantity *linearly* to the standard error estimate,

$$s + \sqrt{\sum_{j=1}^q \delta_j^2} \quad ,$$

or add it *in quadrature* to the standard error estimate,

$$\sqrt{s^2 + \sum_{j=1}^q \delta_j^2}$$

These are frequently considered (erroneously) to correspond to a confidence level with $P=68\%$.

In another method, often termed the PTB approach [6], the component systematic uncertainties are assumed to be independent and distributed such that all values within the estimated limits are equiprobable (rectangular or uniform distribution) [8]. With these assumptions, the rectangular systematic uncertainty distributions can be convoluted to obtain a combined probability distribution for which the variance may be computed. This may then be combined in quadrature with that for the random uncertainty. In its simplest form, the uncertainty components are combined to form an overall uncertainty by

$$u = k \sqrt{s^2 + (1/3) \sum_{j=1}^q \delta_j^2} \quad ,$$

where k is customarily taken as 2 or 3. The above simple form is not appropriate when one of the component δ_j 's is much larger than the others; in such a case it will be more informative to keep that component separate from the others and add it linearly.

A Concluding Thought

If there is one fundamental proposition for the expression of uncertainties, it is

The information content of the statement of uncertainty determines, to a large extent, the worth of the final result.

This information content can be maximized by following a few simple principles:

BE EXPLICIT

PROVIDE DETAILS

DON'T OVERSIMPLIFY

When an overall uncertainty is reported, one should explicitly state how the separate components were combined. In addition, for results of primary importance, a detailed discussion and complete specification of all of the separate uncertainty components is still required. In this way, some users will benefit from having the metrologist's estimate of the overall uncertainty, while more sophisticated users will still have access to all of the information necessary for them to evaluate, combine, or use the uncertainties as they see fit.

REFERENCES AND NOTES

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- [3] Eisenhart, Churchill. Contribution to panel discussion of adjustments of the fundamental physical constants. Langenberg, D. N., Taylor, B. N., eds. *Precision Measurement and Fundamental Constants*, Nat. Bur. Stand. (U.S.) Spec. Publ. 343: 509-518; 1971.
- [4] Youden's burette experiment, *Journal of Quality Technology* 4: 20-23 1972, Jan. Youden, W. J., Systematic errors in physical constants. *Physics Today*, 14, 32-34, 36, 38, 40, 43; 1961, Sept. Reprinted as paper 1.4 in NBS Special Publication 300-1. Youden, W. J., Enduring values, *Technometrics* 14: 1-11; 1972, Feb.
- [5] Campion, P. J.; Burns, J. E.; Williams, A. A code of practice for the detailed statement of accuracy. National Physical Laboratory. London: Her Majesty's Stationery Office. 1953. II-57.
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- [7] Müller, Jörg G. Some second thoughts on error statements. *Nuclear Instruments and Methods* 163, 241-251; 1979.
- [8] A numerical comparison of uncertainty limits resulting from these assumptions with those implied by several alternative distributional assumptions is provided by table 1 on page 184 of [2], and discussed on the same and following page.

Churchill Eisenhart
Ronald Collé
July 1980

Exhibit 2-F. Abbreviations and Symbols

Abbreviations for technical terms conserve space in drawings, specifications, and tables. Ordinarily abbreviations and symbols for units should be used in the text only when preceded by numerals; but when a long word or phrase is repeated many times in an article, it may be replaced by an abbreviation that is explained when it first occurs, for example, electron spin resonance (esr). In general, an abbreviation that is not well known to the reading audience for which the paper is designed should be written out in full the first time, with the abbreviation following in parentheses. No periods are used in abbreviations except in a few special instances. Symbols for units are written in the same way for both singular and plural.

The following list of selected abbreviations and symbols is included here for the convenience of NBS staff members; note that it includes some terms that are being replaced by SI units. For a complete list of units and symbols of the International System of Units (SI) see exhibit 2-D. Some outside journals, such as those of the American Physical Society and the American Chemical Society, publish their own list of abbreviations which should be followed in papers for those journals.

absolute.....	abs	chemically pure.....	CP
acre-foot.....	acre-ft	circa	ca
alternating current	ac	circular	circ
altitude.....	alt	circular mils	cmil
ambient	amb	coefficient.....	coeff
ampere-hour	Ah	cologarithm	colog
amplitude modulation.....	AM	compound.....	compd
angstrom.....	Å	concentrate.....	conc
anhydrous	anhyd	conductivity	cond
antilogarithm.....	antilog	constant	const
approximate.....	approx	contact potential difference	cpd
aqueous.....	aq	continuous wave.....	cw
arc tangent.....	arctan	cosecant	csc
arc cotangent	arc cot	cosine	cos
atmosphere	atm	cotangent.....	cot
atmosphere, standard.....	A _s	crystalline.....	cryst
atomic weight	at. wt	cubic	cu
audiofrequency	af	cubic centimeter.....	cm ³
average	av	cubic foot	ft ³
avoirdupois.....	avdp	cubic feet per second.....	ft ³ /s
azimuth	az or α	cubic inch.....	in ³
barrel.....	bbl	cubic yard.....	yd ³
Baumé.....	Bé	decibel	dB
board foot.....	fbm	degree	deg
boiling point.....	bp	degree Fahrenheit.....	°F
brake horsepower	bhp	diameter.....	diam
Brindell hardness number	Bhn	differential thermal analysis.....	dta
British thermal unit.....	Btu	direct current	dc
calorie.....	cal	efficiency	eff
calculated	calc	electric	elec
candlepower.....	cp	electromagnetic units.....	emu
cathode ray oscilloscope	CRO	electromotive force	emf
centipoise.....	cP	electron spin resonance	esr
chemical	chem	electron volt	eV
		electrostatic units.....	esu
		equation	eq
		equivalent weight	equiv wt
		external	ext
		experiment.....	expt
		experimental	exptl
		exponential	exp
		face-centered cubic.....	fcc
		feet per minute.....	ft/min or fpm
		feet per second.....	ft/s or fps
		figure.....	fig.
		fluid.....	fl
		foot.....	ft
		foot-candle.....	fc
		foot-lambert.....	fL
		freezing point	fp
		frequency modulation.....	FM
		function.....	fn
		gallon	gal
		gallons per minute	gal/min or gpm
		gallons per second	gal/s or gps
		giga-electron volt.....	GeV
		horsepower.....	hp
		hour.....	h
		hyperbolic cosecant.....	csch
		hyperbolic cosine.....	cosh
		hyperbolic cotangent.....	coth
		hyperbolic secant	sech
		hyperbolic sine.....	sinh
		hyperbolic tangent.....	tanh

hyperfine structure	hfs	secant	sec
inch	in	second (angular measure).....	"
inches per second.....	in/s or ips	sensitivity.....	sens
indicated horsepower	ihp	sine	sin
infrared	ir	soluble.....	sol
inside diameter	i.d.	solution	soln
insoluble.....	insol	specific gravity.....	sp gr
intermediate frequency.....	i-f	specific heat.....	sp ht
internal.....	int	specific volume	sp vol
International Critical Tables.....	ICT	spherical candlepower.....	scp
kilocalorie.....	kcal	square.....	sq
kiloelectron volt.....	keV	square foot.....	ft ²
kilowatthour.....	kWh	square inch	in ²
kinetic energy.....	KE	standard	std
lambert.....	L	standard deviation	SD
latitude.....	lat	standard temperature and pressure	STP
limit.....	lim	standing wave ratio	SWR
linear foot	lin ft	symmetrical	sym
liquid	liq	synchronous	sync
logarithm (common).....	log	tangent	tan
logarithm (natural).....	ln or (log _e)	temperature	temp
longitude.....	long.	ultrahigh frequency	uhf
magnetomotive force.....	mmf	ultraviolet	uv
mathematics, mathematical	math	United States Pharmacopoeia	USP
maximum	max	vacuum-tube voltmeter.....	VTVM
mean effective pressure.....	mep	vapor pressure.....	vp
mean horizontal candlepower.....	mhcp	variable frequency oscillator	VFO
melting point.....	mp	versed sine.....	vers
meter-kilogram-second	mks	versus.....	vs
microinch	μin	very high frequency	vhf
miles per hour	mi/h or mph	vibrations per minute.....	vpm
miles per hour per second.....	mphps	weight.....	wt
millilambert	mL	yard.....	yd
minimum.....	min	year	yr
minute	min		
minute (angular measure).....	'		
molar.....	<i>M</i>		
molecular weight.....	mol wt		
negative	neg		
nuclear magnetic resonance	nmr		
number	No.		
observed	obs		
ounce	oz		
outside diameter.....	o.d.		
page.....	p.		
pages	pp.		
parts per million.....	ppm		
peak.....	pk		
pint.....	pt		
positive	pos		
potential difference.....	PD		
potentiometer	pot		
pound	lb		
pounds per brake horsepower-hour	lb/bhp-hr		
pounds per square foot.....	lb/ft ²		
pounds per square inch	lb/in ²		
power factor.....	PF		
precipitate.....	ppt		
pressure-volume-temperature.....	PVT		
probability	prob		
probable error	pe		
quart.....	qt		
radiofrequency	rf		
relative humidity.....	rh		
revolutions per minute	r/min or rpm		
revolutions per second	r/s or rps		
root mean square	rms		

Abbreviations for States and Provinces

UNITED STATES

AL	Alabama
AK	Alaska
AZ	Arizona
AR	Arkansas
CA	California
CO	Colorado
CT	Connecticut
DE	Delaware
FL	Florida
GA	Georgia
HI	Hawaii
ID	Idaho
IL	Illinois
IN	Indiana
IA	Iowa
KS	Kansas
KY	Kentucky
LA	Louisiana
ME	Maine
MD	Maryland
MA	Massachusetts
MI	Michigan
MN	Minnesota
MS	Mississippi
MO	Missouri
MT	Montana
NE	Nebraska

NV Nevada
 NH New Hampshire
 NJ New Jersey
 NM New Mexico
 NY New York
 NC North Carolina
 ND North Dakota
 OH Ohio
 OK Oklahoma
 OR Oregon
 PA Pennsylvania
 RI Rhode Island
 SC South Carolina
 SD South Dakota
 TN Tennessee
 TX Texas
 UT Utah
 VT Vermont
 VA Virginia
 WA Washington
 WV West Virginia
 WI Wisconsin
 WY Wyoming
 CZ Canal Zone
 DC District of Columbia
 GU Guam
 PR Puerto Rico
 VI Virgin Islands

CANADA

AB Alberta
 BC British Columbia
 MB Manitoba
 NB New Brunswick
 NF Newfoundland
 NT Northwest Territories

NS Nova Scotia
 ON Ontario
 PE Prince Edward Island
 PQ Quebec
 SK Saskatchewan
 YT Yukon Territory
 LB Labrador

Greek Alphabet

Caps.	L.C.	Name
A	α	Alpha
B	β	Beta
Γ	γ	Gamma
Δ	δ	Delta
E	ϵ	Epislon
Z	ζ	Zeta
H	η	Eta
Θ	θ	Theta
I	ι	Iota
K	κ	Kappa
Λ	λ	Lambda
M	μ	Mu
N	ν	Nu
Ξ	ξ	Xi
O	\omicron	Omicron
Π	π	Pi
P	ρ	Rho
Σ	σ	Sigma
T	τ	Tau
Y	υ	Upsilon
Φ	ϕ	Phi
X	χ	Chi
Ψ	ψ	Psi
Ω	ω	Omega

Bibliography 2-A. Aids to Scientific and Technical Writing

Copies of all of these aids are available in the NBS Library. Those marked with an asterisk (*) are also available from the NBS storerooms.

*American National Standards Institute. Preparation of scientific papers for written or oral presentation (Z39.16-1979). New York: American National Standards Institute; 1979. 16 p.

This publication details guidelines for style and internal organization, which increase the probability of a scientific or technical paper being accepted for publication and being noticed, read, and understood by the intended readers. It is a valuable and authoritative guide.

*American National Standards Institute. Writing abstracts (Z39.14-1979). New York: American National Standards Institute; 1979. 15 p.

This publication provides guidelines for writing abstracts acceptable to many Government, scientific, and technical organizations.

Barrass, R. Scientists must write: A guide to better writing for scientists, engineers, and students. New York: Wiley; 1978. 176 p.

Written by a scientist who knows both how difficult it is to write well and how important it is for scientists and engineers to do so. Where appropriate the advice given is consistent with ANSI. The book includes exercises, which make it suitable for self-instruction.

Bowman, William J. Graphic communication. New York: John Wiley and Sons; 1968. 210 p.

One of the better-prepared books concerned with clear presentation of ideas through various types of illustrations.

CODATA Bulletin #9. Guide for the presentation in the primary literature of numerical data derived from experiments (Dec. 1973).

Ebbitt, D. R. Writer's guide and index to English, 6th ed. Glenview, Ill: Scott, Foresman, and Company; 1978. 715 p.

This is a standard handbook for any kind of writer. Part I, "The Writer's Guide," has thorough discussions of style, grammar, punctuation, usage, and mechanics. Part II, "The Index to English," is an alphabetical arrangement of the subjects in Part I.

Fowler, H. W. Dictionary of modern English usage, 2d ed. Gowens, E. ed. New York: Oxford University Press; 1965. 742 p.

This is probably the most influential book on English usage. It is written in a vigorous, witty style.

Mills, G. H.; Walter, J. A. Technical writing, 4th ed. New York: Holt, Rinehart, and Winston; 1978. 587 p.

More detailed than Ulman's book and less easy to use for reference, but highly readable with a very sensible approach. There is a good section on publishing in professional journals.

Rathbone, R. R. Communicating technical information: A guide to current uses and abuses in scientific and engineering writing. Reading, Mass.: Addison-Wesley Publishing Company; 1966. 104 p.

A paperback geared for the person who wishes a short review of writing problems in science and engineering. It is readable and well done.

Strunk, W.; White, E. B. The elements of style, 3d ed. New York: Macmillan Publishing Co.; 1979. 85 p.

This little paperback was originally a composition handbook used at Cornell; it has been revised and added to by W. B. White. It is short, to the point, and witty. However, not all the advice given is suitable for scientific writing.

Tichy, H. J. Effective writing for engineers, managers, scientists. New York: John Wiley and Sons; 1966. 337 p.

Excellent coverage of the general field of scientific and technical writing. The author has a very readable style; she provides a useful analysis of common errors and weaknesses in the writing of professionals.

Trelease, S. F. How to write scientific and technical papers. Cambridge, Mass: MIT Press; 1969. 185 p.

A handbook for research workers. Detailed directions for assembling reports and journal articles. Takes up treatment of data, outlining, draft revision, use of libraries, and documentation. Carefully written.

Ulman, J. N., Jr.; Gould, J. R. Technical reporting, 3d ed. New York: Holt, Rinehart, and Winston; 1972. 419 p.

Very well organized for quick reference. Contains several complete reports illustrating good practice plus an extensive section on sentence revision.

Bibliography 2-B. Standards for Symbols, Units, and Nomenclature

All of these standards are available in the NBS Standards Information Library.

American National Standards Institute. Graphic symbols for electrical and electronics diagrams (Y32.2). New York: American National Standards Institute; 1975. 111 p.

American National Standards Institute. Letter symbols for quantities used in electrical science and electrical engineering (Y10.5). New York: American National Standards Institute; 1968. 30 p.

American National Standards Institute. Letter symbols for units in science and technology (Y10.19). New York: American National Standards Institute; 1969. 15 p.

Instrument Society of America. Instrumentation symbols and identification, Standard (ISA S5.1). 1973. 54 p.

McGlashan, M. L. Manual of symbols and terminology for physicochemical quantities and units. London: Pergamon Press; 1979. 41 p.

Bibliography 2-C. Books on Treatment of Data

American Society for Testing and Materials. ASTM manual on presentation of data and control chart analysis (STP 15 D); 1976. 162 p.¹

American Society for Testing and Materials. ASTM standard on precision and accuracy for various applications; 1977. 249 p.

Box, G. E. P.; Hunter, W. G.; Hunter, J. S. Statistics for experimenters, an introduction to design, data analysis, and model building. New York: John Wiley and Sons; 1978. 575 p.¹

Cox, D. R. Planning of experiments. New York: John Wiley and Sons; 1958. 308 p.¹

Daniel, C.; Wood, F. S. Fitting equations to data, computer analysis of multifactor data, 2d ed. New York: John Wiley and Sons; 1979. 342 p.¹

Deming, W. E. Statistical adjustment of data. New York: John Wiley and Sons; 1943. 261 p.¹

Draper, N. R.; Smith, H. Applied regression analysis. New York: John Wiley and Sons; 1966. 407 p.¹

Himmelblau, D. M. Process analysis by statistical methods. New York: John Wiley and Sons; 1970. 463 p.¹

Ku, H. H., ed. Precision measurement and calibration: Statistical concepts and procedures. Nat. Bur. Stand. (U.S.) Spec. Publ. 300; 1969. v.p.^{1,2}

Mandel, J. The statistical analysis of experimental data. New York: Interscience; 1964. 410 p.¹

Mosteller, F.; Tukey, J. W. Data analysis and regression, a second course in statistics. Reading, Mass.: Addison-Wesley; 1977. 588 p.¹

Natrella, M. G. Experimental statistics. Nat. Bur. Stand. (U.S.) Handb. 91; 1963. v.p.^{1,2}

Wilson, E. B. An introduction to scientific research. New York: McGraw-Hill; 1952. 375 p.¹

Youden, W. J. Statistical methods for chemists. New York: John Wiley and Sons; 1951. 126 p.¹

¹NBS Library has a copy.

¹ NBS Library has a copy.

² v.p.-various pagination.

Bibliography 2-D. Style Manuals

Listed below are style manuals that may prove beneficial to NBS authors and editors, as well as manuals used most often by the Technical Information and Publications Division staff. When an author is preparing a manuscript for publication in an outside journal, the style of that particular journal should be followed.

U.S. Government Printing Office. Style manual. Washington, D.C.: U.S. Government Printing Office; 1973. 548 p.

A good guide for authors, editors, and typists on form and style of Government publishing. Available in NBS storeroom.

American Chemical Society. Handbook for authors of papers in American Chemical Society publications, 3d ed. Washington, D.C.: American Chemical Society; 1978. 122 p.¹

Used for many years as an NBS guide for both NBS and ACS publications.

American Institute of Physics, Inc. Style manual for guidance in the preparation of papers for journals, 3d ed. New York: American Institute of Physics; 1978. 56 p.

Used for many years as an NBS guide for both NBS and AIP publications. Available in the NBS storeroom.

Coss, T., ed. Handbook of publishing and printing. Washington, D.C.: U.S. Department of Commerce; 1978. 38 p.

Primarily a handbook for DoC publication offices, but also contains useful information for authors and editors. Available from the Technical Information and Publications Division.

International Union of Pure and Applied Chemistry. Manual of symbols and terminology for physicochemical quantities and units. Elmsford, New York: Pergamon Press; 1973. 41 p.¹

Metric nomenclature—See "NBS Guidelines for Use of the International System of Units (SI)," exhibit 2-D.

While the preceding manuals are of primary importance to NBS authors, the following manuals may be of help when writing for outside publications.

¹NBS Library has a copy.

American Chemical Society. Chemical Abstracts Service source index (CASSI) 1907-1974 cumulative. Columbus, Ohio: Chemical Abstract Service, Ohio State University; 1975.^{1,2}

American Mathematical Society. Manual for authors, 6th ed.; 1978. Reprint from American Mathematical Society Bulletin 68(5); 1962 September.⁴

American National Standards Institute. Basic criteria for indexes (Z39.4). New York: American National Standards Institute; 1974. 12 p.^{1,3}

American National Standards Institute. Guidelines for format and production of scientific and technical reports (Z39.18) New York: American National Standards Institute; 1974. 16 p.¹ (Also available in NBS storeroom.)

Council of Biology Editors. Council of Biology Editors style manual, 4th ed. Arlington, Va.: American Institute of Biological Science; 1978. 265 p.¹

Fieser, L. E. Style guide for chemists. Huntington, N.Y.: Robert Krieger; 1972. 116 p.¹

Institute of Electrical and Electronics Engineers. Information for IEEE authors. Reprint of information for IEEE authors. Spectrum 2(115): 111-116; 1965 August. A supplement to information for IEEE authors. Spectrum 3(91): 91-92; 1966 May.^{1,4}

Journal of American Chemical Society. Notice to authors of papers. (Following the table of contents in the first journal issue each year.)¹

National Bureau of Standards. Editorial format for voluntary product standards. Washington, D.C.: National Bureau of Standards; 1977.³

Skillin, M.; Gay, R. Words into type, a guide in the preparation of manuscripts, 3d ed. Englewood Cliffs, N.J.: Prentice-Hall; 1974. 585 p.¹

Steenrod, N. E.; Halmos, R. How to write mathematics. Providence, R.I.: American Mathematical Society; 1974. 64 p.¹

University of Chicago. A manual of style, 12th ed. Chicago: University of Chicago Press; 1969. 546 p.

¹ NBS Library has a copy.

² Important source for abbreviations.

³ Available in NBS Standards Information Library.

⁴ NBS Library subscribes to the journal in which this guide was originally printed.

Chapter 3

Selecting a Publication Medium and Method of Composition

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Chapter 3

Selecting a Publication Medium and Method of Composition

This chapter provides guidelines to assist authors, managers, editors, and reviewers to select the publication medium and composition method best suited for the results being reported and the intended audiences.

3.1 Selecting a Publication Medium

NBS programs cover a wide range of research and technical services in physics, chemistry, engineering, mathematics, computer sciences, and other areas of science and technology. Bureau publications provide the important method for transmitting results of these activities to the Bureau's diverse external audiences.

This chapter describes the various publication outlets available to Bureau authors and managers. It provides a basis for selecting that outlet most appropriate for the specific subject and best calculated to reach the intended audiences. The publication medium, once selected, may influence the actual writing of a paper, its review, and its effectiveness. Its choice is subject to review during the editorial process (see sec. 1.3).

NBS publications consist of 3 NBS periodicals, 10 nonperiodical series, interagency/internal reports, grant/contract reports, and staff-written articles in the books and journals of professional and technical societies, associations, and trade and commercial organizations.

Available to NBS authors in the NBS publication series and non-NBS media are specific subject-matter channels: (a) that report major NBS programs to specific audiences; (b) that are suitable for detailed reports on NBS research and serve as long-range references; and (c) that are suitable for interim or limited-scope reports to other agencies. A means is also provided for reporting and making public significant results of work performed by outside organizations under contract to NBS. In addition, computer-readable files of NBS developed programs and technical data bases can be made available to NBS user audiences through the National Technical Information Service.

3.2 Publication Outlets Available to NBS Staff

The 17 publication outlets presently issued by the Bureau are listed below. Also given is the page number of the table on the following pages where each publication outlet is described in terms of its purpose, audience, contents, distribution, method of composition, turnaround time, and who is responsible for coordinating its production.

Series	Abbr. or Acronym	Page No.
NBS Papers in Non-NBS Media		3-4
NBS Periodicals		
Journal of Research	NBS JRES	3-4
Journal of Physical and Chemical Reference Data	JPCRD	3-4
Dimensions/NBS	DIM/NBS	3-4
NBS Nonperiodicals		
Monographs	NBS MN	3-6
Handbooks	NBS HB	3-6
Building Science Series	NBS BSS	3-6
Technical Notes	NBS TN	3-6
Special Publications	NBS SP	3-6
National Standard Reference Data Series	NBS NSRDS	3-8
Applied Mathematics Series	NBS AMS	3-8
Federal Information Processing Standards Publications	NBS FIPS	3-8
Voluntary Product Standards	NBS VPS	3-8
Consumer Information Series	NBS CIS	3-8
NBS Interagency and Internal Reports	NBS IR	3-10
Grant/Contract Reports	NBS GCR	3-10
NBS Data Files		
NBS Magnetic Tapes	NBS MT	3-10

Table 3-1. Publication Outlets Available to NBS Staff: Types and Characteristics

SERIES TITLE ABBR. OR ACRONYM	PURPOSE/AUDIENCE	CONTENT
PAPERS IN NON-NBS MEDIA	<p>Purpose: Reports NBS work in outside media best calculated to reach the intended audiences. Appropriate place of publication is selected by the author & approved during the editorial review process.</p> <p>Audience: The subscribers & other readers of the journals & books published by professional organizations, technological associations and commercial publishers.</p>	The results of Bureau research, development, & service activities. Also staff-written book chapters in areas of NBS expertise. (See also sec. 1.4.6.)
<p>Special considerations:</p> <p>Domestic media—(a) All official papers by the staff must indicate that the materials is not subject to copyright. See sec. 1.4.2. (b) Before agreeing to prepare a book chapter in your official capacity, consult the instructions in sec. 1.4.6. (c) Before agreeing to write in a private (nonofficial) capacity, consult the instructions in sec. 1.4.5.</p>		
NBS PERIODICALS Journal of Research NBS JRES	<p>Purpose: Reports research & development in those disciplines of the physical & engineering sciences in which the Bureau is active.</p> <p>Audience: Primarily scientists, engineers, technical specialists, academia, & research laboratories.</p>	Disciplines covered include physics, chemistry, engineering, mathematics, & computer sciences. Papers cover a broad range of subjects, with major emphasis on measurement methodologies & the basic technology underlying standardization. Also included are survey articles on topics closely related to the Bureau's technical & scientific programs. Each issue contains citations to recent publications by the staff in NBS & non-NBS media.
Journal of Physical and Chemical Reference Data JPCRD	<p>Purpose: Provides the principal source of the evaluated data output of the National Standard Reference Data System. (See also NBS NSRDS p. 3-8)</p> <p>Audience: Primarily scientists, engineers, technical specialists, academia, & research laboratories.</p>	Critically evaluated physical & chemical data of material properties that are fully documented as to sources & criteria for evaluation. Also critical reviews of measurement techniques for assessing the accuracy of available data in a given technical area.
DIMENSIONS/NBS DIM/NBS	<p>Purpose: Communicates results of NBS research to both technical experts & interested lay persons.</p> <p>Audience: Primarily researchers, research lab. managers, corporate executives, teachers, consumers, State and local govt. officials.</p>	Contains general feature articles usually prepared by public information specialists, & technical articles written by researchers.

¹ Prices are as of 1980 and are subject to change.² See sec. 3.10 for cost comparison according to 1980 prices.³ From receipt of final copy by TIPD (in Boulder, PIO):

Typeset publications: Time determined by workload, responsiveness of printing procurement process, complexity of text, and promptness of review and approval of galleys and page proofs.

SEE ABBREVIATION ON PAGE 3-11

DISTRIBUTION ¹	METHOD OF COMPOSITION ²	TURNAROUND TIME ³ / COORDINATING RESPONSIBILITY
Sold by the publisher. Reprints are often distributed by & available from author or originating unit. All papers are cataloged & promoted by NBS & are abstracted & cited by NTIS & other bibliographic services.	As prescribed by the publisher. Many publishers typeset from manuscript copy provided by the author; others require camera-ready copy prepared to specific specifications. Complete information appears in the publication or is available from the editor.	Turnaround time: Varies with the journal; usually from 3-18 mo. Coordinating responsibility: The NBS author.
<p>Foreign media—(a) There is no general prohibition against publishing in a foreign publication when such a medium is the best choice for reaching the appropriate scientific & technical community; is widely accessible in the United States; does not originate in a Soviet-bloc or unrecognized country; and is approved by the Center Director (or designee).</p> <p>(b) The regulations of the Office of Export Control, U.S. Department of Commerce, prohibit sending to Soviet-bloc & unrecognized countries unpublished technical information that can be used or adapted for use in connection with any manufacturing or production process.</p>		
Sold by subscription from the SupDoc. Issued six times a yr at \$13 (domestic) & \$16.25 (foreign). Single copies from SupDoc domestic (\$3.00) & foreign (\$3.75). Microfiche copies available for \$3.50 from NTIS. Official distribution to Govt. Depository Libraries, to selected Govt. & other research laboratories worldwide, & to national & international scientific & technical publishers on library exchange agreement. Also reproduced & distributed by microfilm services & others, & is abstracted & cited by most bibliographic services, including Chemical Abstracts & Current Contents. Avg. total NBS distribution is 3,800 copies, plus 200 reprints of each article for author's use.	Typeset into top graphic quality publication produced either from adaptable automated manuscript copy using in-house conversion capability or from manuscript copy submitted to GPO. Printing costs are supported by TIPD.	Turnaround time: Avg. from 3½-4 mo. Coordinating responsibility: Journal's Board of Editors & TIPD.
Published quarterly for NBS by the American Chemical Society (ACS) & the American Institute of Physics (AIP) & available on a subscription basis from ACS & AIP (members \$29, others \$115). Recent total quarterly distribution 1,250 copies. Supplements are published at irregular intervals & are sold separately.	Typeset into top graphic quality publication produced either from adaptable automated manuscript copy using in-house conversion capability or from manuscript copy submitted to GPO. Composition costs are supported by OSRD; final negatives are submitted to the American Institute of Physics for printing & distribution.	Turnaround time: Avg. Avg. from 4-6 mo. Coordinating responsibility: Office of Standard Reference Data & TIPD.
Sold by subscription from SupDoc. Issued 11 times a yr at \$11 (domestic) & \$13.75 (foreign). Official distribution to Govt. & other research laboratories worldwide, & to national & international scientific & technical publishers on Library exchange agreement. Avg. monthly distribution 13,200 copies.	Typeset into top graphic quality publication produced from manuscript copy submitted to GPO. Printing costs are supported by PID.	Turnaround time: Avg. 3-4 mo. Coordinating responsibility: Editor, DIMENSIONS/NBS, Public Information Division.

Table 3-1. Publication Outlets—Continued

SERIES TITLE ABBR. OR ACRONYM	PURPOSE/AUDIENCE	CONTENT
<i>NBS NONPERIODICALS</i> Monographs NBS MN	<p>Purpose: Reports major contributions to technical literature resulting from the Bureau's scientific & technical activities.</p> <p>Audience: Primarily scientists, engineers, technical specialists, academia, & research laboratories.</p>	Complete and extensive report on a research project or a major subject of interest in any areas of NBS research.
Handbooks NBS HB	<p>Purpose: Provides recommended engineering & industrial practice (including safety codes) developed in cooperation with interested industries, professional organizations, & regulatory bodies. Also provides reference information and guidelines.</p> <p>Audience: Primarily scientists, engineers, academia, standards writing organizations, & technical specialists.</p>	Information of a specialized nature dealing directly with scientific & engineering disciplines. Subject matter varies from handbook practices for weights & measures officials to recommended guidelines for radiation protection, noise control, & energy conservation.
Building Science Series NBS BSS	<p>Purpose: Provides technical information developed at the Bureau on building materials, components & whole structures.</p> <p>Audience: Primarily technical professions or technical workers in the building industry & related fields.</p>	Research results, test methods, & performance criteria related to the structural & environmental functions & the durability & safety characteristics of building elements & systems.
Technical Notes NBS TN	<p>Purpose: Provides studies or reports which are complete in themselves. May serve as a report to a sponsor.</p> <p>Audience: Primarily scientists, engineers, technical specialists, academia, research laboratories, & NBS sponsor(s) when applicable.</p>	Similar to monographs but not always as comprehensive in scope or definitive in treatment of the subject area. Often serve as a vehicle for final reports of work performed at NBS under the sponsorship of other Govt. agencies. Specialized subject matter subseries include Selected Values of Chemical Thermodynamic Properties (TN270-), Optical Radiation Measurements (TN594-), & Self Calibrations Manual for Optical Radiation (TN910-).
Special Publications NBS SP	<p>Purpose: Reports technical & programmatic information not suitable for other NBS publication series.</p> <p>Audience: Ranges from general public to specialized subject-oriented audiences.</p>	Proceedings of conferences sponsored by NBS, NBS annual reports, & other special publications such as wall charts, pocket cards, & bibliographies. Specialized subject-matter subseries include Semiconductor Measurement Technology (SP400-), Standard Reference Materials (SP260-), Precision Measurement & Calibration (SP300-), Law Enforcement Technology (SP480-), & Computer Science & Technology (SP500-).

1,2,3 See footnote on p. 3-4.

DISTRIBUTION ¹	METHOD OF COMPOSITION ²	TURNAROUND TIME ³ / COORDINATING RESPONSIBILITY
<p>Sold by the SupDoc & in microfiche (\$3.50) or photocopy (cost varies) by NTIS. Official distribution to Govt. Depository Libraries, to selected Govt. & other research laboratories worldwide, & to national & international technical publishers on Library exchange agreements. Sales figures vary with subject matter, typically 1,000 copies & for wide interest subjects up to 10,000 copies. Official distribution averages 2,700 copies.</p>	<p>Usually typeset into top graphic quality publications produced from adaptable automated manuscript copy using in-house conversion capability or from manuscript copy submitted to GPO. When speed is required & graphic quality is not a major consideration, may be produced from typewritten camera-ready copy prepared by the originating unit. Printing costs are supported by the originating unit.</p>	<p>Turnaround time: Avg. from 4-6 mo. for typeset publication; from 4-6 wk. for typewritten publication.</p> <p>Coordinating responsibility: TIPD.</p>
<p>Sold by the SupDoc & in microfiche (\$3.50) or photocopy (cost varies) by NTIS. Official distribution to Govt. Depository Libraries, to selected Govt. & other research laboratories worldwide, & to national & international technical publishers on library exchange agreements. Sales figure vary with subject matter, typically 1,000 copies & for wide interest subjects up to 10,000 copies. Official distribution averages 2,700 copies.</p>	<p>Usually typeset into top graphic quality publications produced from adaptable automated manuscript copy using in-house conversion capability or from manuscript copy submitted to GPO. When speed is required & graphic quality is not a major consideration, may be produced from typewritten camera-ready copy prepared by the originating unit. Printing costs are supported by the originating unit.</p>	<p>Turnaround time: Avg. from 4-6 mo. for typeset publication; from 4-6 wk. for typewritten publication.</p> <p>Coordinating responsibility: TIPD.</p>
<p>Sold by the SupDoc & in microfiche (\$3.50) or photocopy (cost varies) by NTIS. Official distribution to Govt. Depository Libraries, to selected Govt. & other research laboratories worldwide, & to national & international technical publishers on library exchange agreements. Sales figures vary with subject matter, typically 1,000 copies & for wide interest subjects up to 12,000 copies. Official distribution averages 3,000 copies.</p>	<p>Usually typeset into top graphic quality publications produced from adaptable automated manuscript copy using in-house conversion capability or from manuscript copy submitted to GPO. When speed is required & graphic quality is not a major consideration, may be produced from typewritten camera-ready copy prepared by the originating unit. Printing costs are supported by the originating unit.</p>	<p>Turnaround time: Avg. from 4-6 mo. for typeset publication; from 4-6 wk. for typewritten publication.</p> <p>Coordinating responsibility: TIPD.</p>
<p>Sold by the SupDoc & in microfiche (\$3.50) or photocopy (cost varies) by NTIS. Official distribution to Govt. Depository Libraries, to selected Govt. & other research laboratories worldwide, & to national & international technical publishers on library exchange agreements. Sales figures vary with subject matter, typically 500 copies & for wide interest subjects up to 4,500 copies. Official distribution averages 1,200 copies.</p>	<p>Usually typewritten camera-ready copy prepared by the originating unit. Printing cost is chargeable to the appropriate cost center within the originating unit.</p>	<p>Turnaround time: from 4-6 wk.</p> <p>Coordinating responsibility: TIPD.</p>
<p>Sold by the SupDoc & in microfiche (\$3.50) or photocopy (cost varies) by NTIS. Official distribution to Govt. Depository Libraries, to selected Govt. & other research laboratories worldwide, & to national & international technical publishers on library exchange agreements. Sales figures vary with subject matter, typically 1,000 copies & for wide interest subjects up to 100,000 copies. Official distribution averages 2,200 copies.</p>	<p>Usually typeset into top graphic quality publications produced either from adaptable automated manuscript using in-house conversion capability or from manuscript copy submitted to GPO. When speed is required & graphic quality is not a major consideration, may be produced from typewritten camera-ready copy prepared by originating unit (often used for NBS-sponsored proceedings). Printing costs are supported by the originating unit (for conference proceedings see sec. 5.1.7.)</p>	<p>Turnaround time: from 4-6 mo. for typeset publication; from 4-6 wk. for typewritten publication.</p> <p>Coordinating responsibility: TIPD; PID for certain general publications.</p>

Table 3-1. Publication Outlets—Continued

SERIES TITLE ABBR. OR ACRONYM	PURPOSE/AUDIENCE	CONTENT
<i>NBS NONPERIODICALS (Con't.)</i>		
National Standard Reference Data Series NBS NSRDS	<p>Purpose: Provides an alternate source of evaluated data output of the National Standard Reference Data System under the authority of the National Standard Data Act (PL 90-396). (See also JPCRD.)</p> <p>Audience: Primarily scientists, engineers, technical specialists, academia, & research laboratories.</p>	<p>Critically evaluated physical & chemical property data of material properties fully documented as to original sources & the criteria that are used for evaluation. Also included are critical reviews of measurement techniques, whose aim is to assess the accuracy of available data in a given technical area.</p>
Applied Mathematics Series NBS AMS	<p>Purpose: Provides mathematical material compiled as part of the Bureau's work.</p> <p>Audience: Primarily physicists, engineers, chemicals, biologists, mathematicians, computer programmers, & others engaged in scientific & technical work.</p>	<p>Mathematical tables, manuals, & studies of special interest.</p>
Federal Information Processing Standards Publications NBS FIPS	<p>Purpose: Provides standards for implementation by Federal Agencies in the acquisition, development, & use of automated information systems; & in the interchange of data among agencies & with the public. Such standards are adopted after extensive review by Federal agencies, industry, & the public. Their use is intended to reduce Govt. costs & improve the effectiveness of Govt. services.</p> <p>Audience: Primarily individuals & managers of ADP activities in the Federal Govt. Also ADP personnel in State and local Govt., business, & manufacturers of ADP equipment & services.</p>	<p>Standards & guidelines for improving utilization of ADP systems in the Federal Govt.</p> <p>Note: This series constitutes the FIPS Register per Public Law 89-306 (79 Stat. 1127), Executive Order 11717 (38 FR 12315, May 11, 1973), and Part 6 of Title 15 CFR.</p>
Voluntary Product Standards NBS VPS	<p>Purpose: Provides all concerned interests with a basis for common understanding of the characteristics of products. Developed under procedures published by the DoC in Part 10, Title 15, of the Code of Federal Regulations to establish nationally-recognized requirements for products. NBS administers this program as a supplement to the activities of the private standards-writing organizations.</p> <p>Audience: Primarily producers, distributors, consumer/users, & other Govt. agencies having an interest in the particular subject standard.</p>	<p>Includes classifications, definitions, requirements, & inspection & testing procedures used in manufacturing, marketing & purchasing of products, processes, or procedures.</p>
Consumer Information Series NBS CIS	<p>Purpose: Provides practical consumer information, based on NBS research & experience.</p> <p>Audience: Primarily the general public.</p>	<p>Easily understandable text & illustrations provide useful background knowledge for shopping & living in today's technological world.</p>

1,2,3 See footnote on p. 3-4.

DISTRIBUTION ¹	METHOD OF COMPOSITION ²	TURNAROUND TIME ³ / COORDINATING RESPONSIBILITY
<p>Sold by the SupDoc. & in microfiche (\$3.50) or photocopy (cost varies) by NTIS. Official distribution to Govt. Depository Libraries, to selected Govt. & other research laboratories worldwide, & to national & international technical publishers on library exchange agreements. Official distribution averages 375 copies. Sales figures vary with subject matter, typically 4,000 copies & for wide interest subjects up to 25,000 copies.</p>	<p>Typeset into top graphic quality publications produced either from adaptable automated manuscript copy using in-house conversion capability or from manuscript copy submitted to GPO. Printing costs are supported by OSRD.</p>	<p>Turnaround time: Avg. from 4-6 mo.</p> <p>Coordinating responsibility: Office of Standard Reference Data & TIPD.</p>
<p>Sold by the SupDoc & in microfiche (\$3.50) or photocopy (cost varies) by NTIS. Official distribution to Govt. Depository Libraries, to selected Govt. & other research laboratories worldwide, & to national & international technical publishers on library exchange agreements. Sales figures vary with subject matter, typically 1,500 to 2,000 copies. (ASC55 on mathematical functions has reached 132,000 by SupDoc; 100,000 by a private contractor.)</p>	<p>Typeset into top graphic quality publications produced either from adaptable automated manuscript copy using in-house conversion capability or from manuscript copy submitted to GPO. Printing costs are supported by the originating unit.</p>	<p>Turnaround time: Avg. from 4-6 mo.</p> <p>Coordinating responsibility: TIPD.</p>
<p>Sold individually or by subscription from NTIS. Initial agency distribution about 4,000 copies. NTIS subscription and individual sales range from 1,000 to 4,000.</p>	<p>Typeset into top graphic quality publications produced either from adaptable automated manuscript copy using in-house conversion capability or from manuscript copy submitted to GPO. Proposed FIPS Federal Standards are published in the Federal Register for public comment & review prior to final publication. Printing costs are supported by the originating unit.</p>	<p>Turnaround time: Avg. from 3½-4 mo.</p> <p>Coordinating responsibility: Stds. Adm. Office of ICST & TIPD.</p>
<p>Sold by the SupDoc. Appropriate VPS are listed as American National Standard by ANSI. Distribution up to 10,000 copies is made by proponent organizations to promote use of the standard. NBS distribution & SupDoc sales range from 1,000 to 5,000 copies.</p>	<p>Typeset into top graphic quality publications produced either from adaptable automated manuscript copy using in-house conversion capability or from manuscript copy submitted to GPO. Printing costs are supported by proponent organizations.</p>	<p>Turnaround time: Avg. from 3½-4 mo.</p> <p>Coordinating responsibility: NBS Office of Engineering Standards & TIPD.</p>
<p>Sold by the SupDoc & in microfiche (\$3.50) or photocopy (cost varies) by NTIS. Official distribution to Govt. Depository Libraries & liberal official distribution by NBS, cooperating sponsor agencies, & others. Total distribution figures for CIS range from tens of thousands to hundreds of thousands of copies.</p>	<p>Typeset into top graphic quality publications with excellent illustrations & produced in 2 or more colors. Printing costs are supported by the originating unit & by cooperating agencies.</p>	<p>Turnaround time: Avg. from 3½-5 mo.</p> <p>Coordinating responsibility: Public Information Division & TIPD.</p>

Table 3-1. Publication Outlets—Continued

SERIES TITLE ABBR. OR ACRONYM	PURPOSE/AUDIENCE	CONTENT
<i>NBS NONPERIODICALS (Con't.)</i>		
NBS Interagency and Internal Reports NBSIR	<p>Purpose: Primarily provides a medium for interim or final reports on work performed by NBS for outside sponsors (both Govt. & non-Govt.). Also used to report results of NBS projects of transitory or limited interest, or that will be subsequently published in more comprehensive form. NOTE: Technical Notes & other series are also used for this purpose when acceptable to the sponsor. (See sec. 1.5.1.)</p> <p>Audience: Initially, the sponsor & others as specified by the sponsor, plus the technical community served by other similar subject-matter series.</p>	Progress & final reports of results of NBS work performed for other Govt. agencies or under the industrial research associate plan. This series is also used for less comprehensive results of the Bureau's scientific and technical work.
Grant/Contract Reports NBS GCR	<p>Purpose: Reports work of an outside person or organization working under grant or contract from NBS. This series is used when the scientific project officer decides that a contract report has sufficient technical merit to be made publicly available through NTIS. When justified & so recommended by the project officer, grant/contract reports can be incorporated into a formal NBS series. (See sec. 3.6.)</p> <p>Audience: Primarily technical audiences served by NBS series of similar subject matter.</p>	Results of work performed under grant or contract to NBS.
NBS DATA FILES NBS Magnetic Tapes NBS MT	<p>Purpose: Provides the results of NBS computer programs and data files in computer-machine readable form, when a demand for such information is foreseen.</p> <p>Audience: Primarily data centers, scientists, engineers, scientists, academia, and research laboratories.</p>	Technical data compilations; including Standard Reference Data and Federal Information Processing Standards, and well-documented computer programs.

1,2,3 See footnote on p. 3-4.

DISTRIBUTION ¹	METHOD OF COMPOSITION ²	TURNAROUND TIME ³ / COORDINATING RESPONSIBILITY
Initial distribution handled by NBS and/or the sponsor by mutual agreement. Public distribution, if any, is handled by NTIS, in paper copy or microfiche form. Report may receive restricted distribution due to proprietary information, preliminary results, or policy recommendations (see sec. 1.5.3(2)). Sponsor & author distribution avgs. 75–100 copies; sales by NTIS avg. 75 copies.	Typewritten camera-ready copy publications prepared by the originating unit & submitted directly to NBS Printing & Duplicating Unit (PIO in Boulder) for reproducing in-house, by DoC, or by a printing contractor. In-house reproduction costs (within authorized limitations) are supported by the Printing & Duplicating Unit; when outside, reproduction costs are borne by the originating unit.	Turnaround time: from 3–6 wk. Coordinating responsibility: Printing & Duplicating Unit (PIO in Boulder) & author/originating unit.
Initial distribution handled by the NBS scientific project officer; public distribution by NTIS in paper copy or microfiche form. Entry into NTIS is handled by TIPD. Sales by NTIS avg. 50 copies.	Usually produced by the contractor or grantee & provided to the scientific project officer in quantities specified by the contract. Alternately, the project officer may prepare final camera-ready copy & submit it to NBS' Printing & Duplicating Unit for reproduction in-house or by the DoC; in Boulder submit to PIO.	Turnaround time: from 2–3 wk. from receipt by Printing & Duplicating Unit; in Boulder, from 2–6 wk. Coordinating responsibility: Scientific Project Officer Printing & Duplicating, & TIPD (PIO in Boulder).
Magnetic tapes are sold by NTIS in one or more tape recording modes, or as part of a tape and documentation parcel. Entry into NTIS is handled by TIPD, following clearance by the appropriate ERB.	IBM-compatible tape reel in 2,400 or 600-foot lengths, fully described by accompanying Form NTIS-231 "NTIS Computer Products Catalog Data Sheet" or Standard Form 277 "Computer Magnetic Tape File Properties." These forms and complete instructions for submitting tapes are available from TIPD.	Turnaround time: Avg. from 4–6 wk. from receipt of tape and forms by TIPD. Coordinating responsibility: author/originating unit and TIPD.

Abbreviation Key:

GPO—Government Printing Office

NTIS—National Technical Information Service

PID—Public Information Division

PIO—Program Information Office (Boulder)

SupDoc—Superintendent of Documents

TIPD—Technical Information and Publications Division

3.3 Bibliographic Subscription Services

The Cryogenic Data Center of NBS-Boulder has developed specialized bibliographic services designed to provide interested audiences with information on latest developments in certain fields. The periodicals listed below are available by subscription from the National Bureau of Standards, Cryogenic Data Center (216) Boulder, Colorado 80303.

Cryogenic Data Center Current Awareness Service
Publications and reports of interest in cryogenics. A literature survey issued biweekly. Annual subscription: domestic, \$35; foreign, \$45.

Liquefied Natural Gas

A literature survey issued quarterly. Annual subscription: \$30.

Superconducting Devices and Materials

A literature survey issued quarterly. Annual subscription: \$45.

3.4 Duplicate Publication

In general, it is Bureau policy to discourage duplicate publication of papers by NBS staff members. However, a paper published by NBS is in the public domain, and outside publishers are free to reprint the paper in whole or in part if they wish.

The Bureau recognizes that duplicate publication may sometimes be desirable or necessary as a means of increasing the dissemination of technical information. Preferably, the more detailed version is published in the *Journal of Research* or in one of the Bureau's other publication series. A shorter paper may be published elsewhere which omits details of methods, procedures, and analysis of investigations, but which contains a footnote citing the original NBS publication for those readers who may want more details. Also, a number of NBS papers reporting parts of a long-range investigation may, upon completion of the investigation, be consolidated into one paper and then submitted for publication in a different NBS series. In general, when an original research paper appears in conference proceedings with restricted circulation (particularly in foreign publications), the NBS author is encouraged to submit the material for publication in a medium of wider distribution, such as one of the NBS publication series or an appropriate domestic journal.

3.5 Issuance Procedures of Grant/Contract Reports Prepared Under NBS Contract

The scientific project officers who administer NBS grants or contracts should encourage publication of significant results. If publication is

warranted by the quality of the work performed, the place of publication is determined by negotiation between the NBS sponsor and the contractor. Where applicable, the contractor reports should follow the procedures and format prescribed for NBSIRs in section 4.4 and exhibits 4-B and 4-C. Publications should be in English and available to the U.S. public.

Scientific project officers should review manuscripts for general conformance to NBS policies (use of trade names, etc.). In addition, they should make sure that the manuscript is appropriately labeled as work performed under sponsorship of (or under contract to) the National Bureau of Standards and is in the public domain and not subject to copyright if the contract so specifies (see sec. 1.4.3). Scientific project officers should provide the Technical Information and Publications Division (TIPD) with 14 copies (for official use) of all reports resulting from such programs.

When the publication is intended for a non-NBS medium, NBS scientific project officers determine the need for technical review by NBS. When appropriate, they may recommend that significant results be published in the Bureau's series. Manuscripts slated for publication in the NBS series must be reviewed and approved by both the scientific project officer and the appropriate ERB.

When a grant/contract report is not published in an NBS series, the scientific project officer may submit the report, as received from the contractor, directly to TIPD (ERB review is not required) for entry into the National Technical Information Service (NTIS) for public announcement and sale. To do so, the scientific project officer should:

- (1) Request a grant/contract report (GCR) number from TIPD (in Boulder, the Program Information Office (PIO)). TIPD (or PIO) records the report title, author, author's organization, the project and contract numbers under which the work was performed, and the report date.
- (2) Enter the assigned GCR number in ink on the upper right corner of the report cover of all copies of the report.
- (3) Prepare Form NBS-114A (Bibliographic Data Sheet) filling in all appropriate boxes (see exh. 3-A).
- (4) Verify that all pages are numbered consecutively. Do not affix numbers to blank pages, but count them.
- (5) Submit up to 14 copies to TIPD for official use and entry into NTIS inventory. In Boulder, submit up to 10 copies to PIO for transmittal to TIPD. TIPD and PIO will notify the originating NBS unit when the NTIS order number and price are known.

When a scientific project officer decides to have additional copies of a contractor report reproduced by Gaithersburg or Boulder Printing and

Duplicating, the format guidelines for NBSIRs should be followed for the main body of the text (see sec. 4.4 and ex. 4-B). Typewritten copy submitted to Printing and Duplicating for photosetting the covers and title pages should identify such documents as grant/contract reports prepared for NBS. A sample cover, title page, and bibliographic data sheet are shown in exhibit 3-A.

3.6 Selecting a Method of Composition

If the method of composition is not established by the specific publication medium selected and approved as the most appropriate, (see sec. 3.2), the composition method that best suits the nature, significance, and archival consideration of the paper should be selected. Authors should recommend the highest quality method that circumstances permit. The quality is especially relevant when the NBS paper is likely to be used and referenced by peers and the public for years to come. In making a decision, authors are encouraged to consult with their manager or with TIPD (in Boulder, PIO).

For NBS publications, the two methods of composition most commonly used are typesetting (accomplished in two ways) and typewritten camera-ready copy. A typeset publication is produced either by converting an automated or computerized manuscript into an electronically typeset form using TIPD's in-house capability, or by submitting a TIPD-edited manuscript to the Government Printing Office (GPO) for conversion into a typeset form. A typewritten camera-ready copy publication is produced from clean typewritten copy prepared by the originating unit and submitted to TIPD, except for an NBSIR which is submitted in camera-ready form to Gaithersburg Printing and Duplicating (in Boulder, PIO). See exhibit 3-B for sample pages showing the appearance of both methods of composition.

3.7 Typeset Publications

3.7.1 Procedures for Electronic Typesetting Using In-House Capability

Electronic typesetting (also called phototypesetting and photocomposition) requires that original manuscript typing (keystrokes) be recorded in some retrievable form for further processing and typesetting. The high-quality appearance achieved by this process is equivalent to that of hot-metal typesetting but involves much less time and cost. (The use of hot metal to set type is declining in favor of modern printing technologies that use a computer-assisted typesetting process.)

Early contact with TIPD/Electronic Typesetting (in Boulder, through PIO) is recommended when a

typeset publication is required or desired. Electronic typesetting requires that the manuscript be recorded in one of the following eight forms for reading into the NBS computer:

- (1) paper tapes,
- (2) magnetic cards,
- (3) magnetic tapes,
- (4) punched cards,
- (5) ATS files,
- (6) DEC System 10/11 files,
- (7) EdText files, or
- (8) mass storage files.

Even though recorded in one of these eight forms, some manuscripts may not be candidates for this process. Other important factors in using this in-house capability are scheduling, budgeting, and stylistic requirements.

Once a decision has been made to use electronic typesetting and the necessary editorial review is completed, the publication process continues as follows:

- (1) The approved final manuscript copy, its recorded form and bibliographic data sheet (Form NBS-114A) (or, if a computer file, the name of the file), are forwarded to TIPD/Electronic Typesetting (in Boulder, through PIO).
- (2) The manuscript is reviewed by TIPD for conformity to Bureau policies, practices, and other editorial matters. The format is determined, illustrations are checked and sized, and requirements for covers, artwork, paper stock, binding, and number of copies are determined in consultation with the author or the originating unit. Detailed printing specifications are prepared.
- (3) The manuscript's recorded form is embedded with typesetting codes which specify to the computer such things as type faces, type sizes, column widths, and special characters. Using special computer programs these codes are then translated, and a magnetic tape is produced.
- (4) The magnetic tape containing the coded manuscript is sent to GPO through the Department of Commerce (DoC). Illustrations, if any, are forwarded at the same time.
- (5) The magnetic tape is processed on the GPO photocomposition equipment which produces typeset paper-positive masters in galley form.
- (6) The photocopy proofs of the galleys are sent to TIPD where two sets are forwarded to the author for review (in Boulder, through PIO). Since the automated manuscript as received from the originating unit has not been rekeyboarded (retyped), a minimal amount of detailed proofreading is required. Any required corrections should, of course, be indicated; however, nonessential changes are not allowed at this time because of the high cost of making changes (see exh. 2-C for proofreading symbols).

(7) One set of marked-up galley proofs indicating changes is returned to TIPD/Electronic Typesetting (in Boulder, through PIO) where the changes are reviewed and transferred to a master galley proof for GPO. At this time, a "dummy" copy may be prepared to show placement of the artwork combined with the text. This copy is reviewed by the author and any necessary adjustments made.

(8) The marked-up master galley proof and dummy copy are then submitted to GPO through DoC for corrections and final page make up.

(9) The photocopy proofs of the pages of the final copy are forwarded to TIPD/Electronic Typesetting. Two sets are sent to the author (in Boulder, through PIO) for review.

(10) One set of marked-up page proof is returned to TIPD/Electronic Typesetting (in Boulder, through PIO) with an approval for printing.

3.7.2 Procedures for Typesetting by GPO or Under a GPO Contract

Producing a typeset publication through GPO offers the same high-quality typeset output as that using the TIPD in-house capability, but involves somewhat different procedures and requires more time and expense. This method is used when a typeset publication is required or desired and (1) the manuscript is not in automated form or (2) style, scheduling, and other requirements can not be met using TIPD's in-house capability, including instances when the manuscript may be in automated form.

After deciding to use GPO typesetting and editorial review is completed, the publication process continues as follows:

(1) The approved final manuscript copy and bibliographic data sheet (Form NBS-114A) are forwarded to TIPD (in Boulder, through PIO). (See sec. 4.2 for complete information regarding typing procedures.)

(2) The manuscript is reviewed by TIPD for conformity to Bureau policies, practices, and other editorial matters. The format is determined, illustrations are checked and sized, and requirements for covers, artwork, paper stock, binding, and number of copies, are determined in consultation with the author. Detailed printing specifications are prepared.

(3) The manuscript is marked by TIPD with detailed instructions to the printer for conversion into a typeset form. Instructions include such things as type faces, type sizes, column widths, and special characters.

(4) The marked-up manuscript is sent to GPO through DoC. Illustrations, if any, are sent at the same time.

(5) The manuscript is converted into a typeset galley form by the printer. The actual typesetting may be done using hot type, but more likely, will be done using electronic typesetting.

(6) The photocopy proofs of the master galleys are sent to TIPD where two sets are forwarded to the author (in Boulder, through PIO) for review. Since the manuscript as received from the originating unit has been converted to type, detailed proofreading is required. Any required corrections should, of course, be indicated; however, nonessential changes are not allowed at this time because of the high cost of making changes. (See ex. 2-C for proofreading symbols.)

(7) One set of marked-up galley proofs indicating changes is returned to TIPD (in Boulder, through PIO) where the changes are reviewed and transferred to a master galley proof for GPO. At this time, a "dummy" copy may be prepared to show placement of the artwork combined with the text. This copy is reviewed by the author and any necessary adjustments made.

(8) The marked-up galley proof and dummy copy are then submitted to the GPO through DoC for corrections and final page make up.

(9) The photocopy proofs of the pages of the final copy are forwarded to TIPD. Two sets are sent to the author (in Boulder, through PIO) for review.

(10) One set of marked-up page proofs is returned to TIPD (in Boulder, through PIO) with an approval for printing.

3.8 Typewritten Camera-Ready Copy Publications

For typewritten camera-ready copy publications, authors must furnish TIPD (in Boulder, PIO) with a clean, typed copy of the entire document, including a bibliographic data sheet (Form NBS-114A). It is directly from this typewritten copy that the negatives for reproduction are made. The final publication will not have the graphic quality achieved by typesetting, but with careful selection of typing elements and carefully planned formats the final appearance can be enhanced. (See sec. 4.4 for complete instructions regarding typing procedures.)

Typewritten camera-ready copy publications require more pages for a given paper than typeset publications, resulting in a higher sales price for the publication. TIPD can assist in initial planning to reduce the number of pages. However, preparation of the final error-free copy rests exclusively with the author and the originating unit.

3.9 Cost Comparisons

Production costs for a publication will be mainly determined by the method of composition and by other related considerations, such as special paper requirements, use of color, desired schedules, and hard or soft cover. The production methods for all NBS publication series are described in table 3-1 in section 3.2. The costs are supported by the Bureau's overhead fund, by the originating units, by outside sponsors, or by conference fees, depending on the type of the publication.

For planning purposes, originating units may use tables 3-2 and 3-3 in estimating printing costs for publications. The figures are based on an initial run of 1000 copies. A portion of the copies will be used to meet NBS official requirements, and the balance will be for the use of the originating division. If a larger print run is required, costs will increase.

Costs in the tables are determined on the basis of January 1980 data, and are subject to change. In table 3-2, straight copy means plain text only. Moderately difficult copy consists of plain text that includes a small number of equations or other symbols, or a small number of text pages incorporating artwork and tables. Difficult copy consists of complex technical material including many equations or other special symbols, or including a substantial amount of text pages incorporating artwork and tables.

The cost estimates in table 3-2, should permit the originating unit to make an initial estimate for a

standard publication having no unusual features or requirements. Table 3-3 lists some nonstandard requirements that increase the cost of the publication, and how such requirements could affect the total publishing cost.

In addition, the use of more than one color, or the use of special nonstandard paper stock requires special written justification by the originating division for TIPD endorsement and transmittal to DoC for approval. In some cases, DoC will seek the approval of the Joint Committee on Printing. The justification memo from the division must meet the criteria specified by the DoC *Handbook of Publishing and Printing* (p. 4). The memo should include:

- (1) Title of publication and NBS publication series.
- (2) Number of colors to be used.
- (3) Number of color illustrations.
- (4) Sample copies of the color illustrations.
- (5) Strong justification for the use of color.

When a completed manuscript is submitted to TIPD or PIO, in Boulder, the specifications and cost estimate are reviewed and, if necessary, revised. If it is necessary to modify the estimate by 10 percent or more, the originating unit is notified, and the reasons explained by TIPD or PIO production personnel.

Table 3-2. Cost Estimates for Standard Publishing(1980)

Method of Composition	Cost of Publishing (\$ per page)		
	Straight Copy	Moderately Difficult Copy	Difficult Copy
Electronic typesetting using in-house capability	20	40	60
Typesetting by GPO or under a GPO contract	50	75	125
Typewritten camera-ready copy	10	10-12 ^a	12-15 ^a

^aCost varies with number and type of halftones and other illustrations that the printer must incorporate into the text pages.

Table 3-3. Effects of Nonstandard Requirements on Publication Costs(1980)

Nonstandard Requirement	Approximate Effect on Total Publishing Costs
Use of two colors	Add 1/3 to total estimate
Use of four colors	Request individual estimate from TIPD
Nonstandard paper	Add 10-20% or more to original estimate
Special quality control	Add 25-100% to original estimate
Hard cover	Add \$1.50 per copy
Expedited delivery	Add 25-100% to original estimate

Exhibit 3-A. Sample Cover, Title Page, and Bibliographic Data Sheet for Grant or Contract Reports

GCR Cover

NBS-GCR-80-191	Report number Assigned by TIPD or PIO (ERB Approval not required for GCRs)
An Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the University Nursing Home on April 13, 1979	Title and Subtitle (if any)
J. L. Bryan and P. J. DiNenno	Author(s)
January 1980	Date
Prepared for U.S. Department of Commerce National Bureau of Standards Washington, DC 20234 and U.S. Department of Health, Education and Welfare Washington, DC 20201	Sponsoring Agencies (NBS, Others) and Address

GCR Title Page

NBS-GCR 80-191	Report number Assigned by TIPD or PIO (ERB Approval not required for GCRs)
AN EXAMINATION AND ANALYSIS OF THE DYNAMICS OF THE HUMAN BEHAVIOR IN THE FIRE INCIDENT AT THE UNIVERSITY NURSING HOME ON APRIL 13, 1979	Title and Subtitle (if any)
J. L. Bryan and P. J. DiNenno	Author(s)
University of Maryland Fire Protection Curriculum College Park, MD 20742	Organization and Address (Title Page Only)
January 1980	Date
NBS Grant 7-9014	Contract number, if desired
Prepared for Center for Fire Research National Bureau of Standards Washington, DC 20234 and U.S. Department of Health, Education and Welfare Washington, DC 20201	Sponsoring Agencies (NBS, Others) and Address (Omit masthead information on GCRs)

Note: Grant/Contract Reports (GCRs) follow the same format as for NBSIRs, except that the DoC/NBS masthead information must be omitted. Show instead that the report was "Prepared for the National Bureau of Standards (address) and (other sponsoring agency, if any, and address)". Submit cover and title pages as typewritten copy; the NBS duplicating unit will convert these to phototype. See next page for NBS Form-114A, Bibliographic Data Sheet (Refer also to sec. 3.5)

NBS-114A (REV. 2-80)			
U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET <i>(See instructions)</i>		1. PUBLICATION OR REPORT NO. NBS-GCR-80-191	2. Performing Organ. Report No.
		3. Publication Date January 1980	
4. TITLE AND SUBTITLE An Examination and Analysis of the Dynamics of the Human Behavior in the Fire Incident at the University Nursing Home on April 13, 1979			
5. AUTHOR(S) John L. Bryan and Philip J. DiNenno			
6. PERFORMING ORGANIZATION <i>(If joint or other than NBS, see instructions)</i> University of Maryland Fire Protection Curriculum College Park, MD 20742		7. Contract/Grant No. 7-9014	8. Type of Report & Period Covered
9. SPONSORING ORGANIZATION NAME AND COMPLETE ADDRESS <i>(Street, City, State, ZIP)</i> National Bureau of Standards Department of Commerce Washington, DC 20234			
10. SUPPLEMENTARY NOTES Sponsored by the HEW/NBS Life/Fire Safety Program <input type="checkbox"/> Document describes a computer program; SF-185, FIPS Software Summary, is attached.			
11. ABSTRACT <i>(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here)</i> At approximately 0833 hours on April 13, 1979, the smoke detector located on the ceiling of the lounge area at the south end of the corridor of the South Section of B wing on the second floor activated in the University Nursing Home, 901 Arcola Avenue, Silver Spring, Maryland. This detector was activated by a flow of convected heat and dark smoke from the door of patient room 27, 15 feet to the North. The activation of this smoke detector automatically initiated the activation of the local alarm system. The receptionist upon hearing the alarm notified the Montgomery County Emergency Operations Center. The nursing staff were able to close the doors to all the patient rooms in both the South and West Sections of B wing with the exception of the door to the room of fire origin, room 27. The room experienced flashover and the rapidly spreading heat and smoke forced the staff out of the area. The smoke barrier doors closed with the activation of the local alarm system and prevented the spread of smoke extensively to the West Section and in particular to A wing. Approximately 21 patients were removed from rooms in the South Section by the fire department, 7 of these down ladders. An additional 26 patients were evacuated from the West Section of B wing. Seventeen patients were transported to hospitals for medical treatment with eight staff members. Two of these patients subsequently died. The total fire department response involved three alarms. The fire was extinguished within 5 minutes of the arrival of the first engine and within 9 minutes of smoke detector activation.			
12. KEY WORDS <i>(Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons)</i> death; doors; egress; evacuation; fire alarm systems; fire departments; fire fighters; flashover; nursing homes; nursing staff; patients; room fires; smoke detectors.			
13. AVAILABILITY <input checked="" type="checkbox"/> Unlimited <input type="checkbox"/> For Official Distribution. Do Not Release to NTIS <input type="checkbox"/> Order From Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. <input checked="" type="checkbox"/> Order From National Technical Information Service (NTIS), Springfield, VA. 22161		14. NO. OF PRINTED PAGES 36 15. Price \$6.00	

USCOMM-DC 6043-P80

All GCRs submitted for NTIS availability must be accompanied by Form NBS-114A. See reverse of Form or exhibit 1-E(a) for instructions for completing form.

Exhibit 3-A (cont.)

Exhibit 3-B. Samples of Typeset Copy and Typewritten Camera-Ready Copy

Typeset

**STUDY OF ORGANOMETAL SPECIATION IN WATER SAMPLES
USING LIQUID CHROMATOGRAPHY
WITH ELECTROCHEMICAL DETECTION****W. A. MacCrehan and R. A. Durst***National Bureau of Standards
Washington, D.C. 20234***J. M. Bellama***University of Maryland
College Park, Maryland 20742*

A new measurement technique for trace organometal analysis employing liquid chromatography with electrochemical detection is described. Important considerations in the optimization of sensitivity and selectivity of this detection approach are discussed.

A column preconcentration for methyl- and ethylmercury from water samples is outlined.

Key words: Electrochemical detection; liquid chromatography; methylmercury; organometals; water preconcentration.

I. Introduction

Mounting concern over the presence and role of toxic substances in the environment and living systems has created the need for selective and sensitive measurement techniques. Methodology now exists for the analysis of heavy metals (an important class of pollutants) in a variety of matrices, and considerable effort is being devoted to the collection of data on the levels of these elements in biota and water samples. However, some toxic elements can be transformed into organometals by biological and chemical processes. Organometallic species have different properties from their inorganic counterparts. Thus, in order to fully understand the role of these toxic materials, it is necessary to measure the exact chemical form of the element in the sample.

Typewritten

STUDY OF ORGANOMETAL SPECIATION IN WATER SAMPLES
USING LIQUID CHROMATOGRAPHY
WITH ELECTROCHEMICAL DETECTION

W. A. MacCrehan and R. A. Durst

National Bureau of Standards
Washington, D.C. 20234

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College Park, Maryland 20742

A new measurement technique for trace organometal analysis employing liquid chromatography with electrochemical detection is described. Important considerations in the optimization of sensitivity and selectivity of this detection approach are discussed.

A column preconcentration for methyl- and ethylmercury from water samples is outlined.

Key words: electrochemical detection; liquid chromatography; methylmercury; organometals; water preconcentration.

1. Introduction

Mounting concern over the presence and role of toxic substances in the environment and living systems has created the need for selective and sensitive measurement techniques. Methodology now exists for the analysis of heavy metals (an important class of pollutants) in a variety of matrices, and considerable effort is being devoted to the collection of data on the levels of these elements in biota and water samples. However, some toxic elements can be transformed into organometals by biological and chemical processes. Organometallic species have different properties from their inorganic counterparts. Thus, in order to fully understand the role of these toxic materials, it is necessary to measure the exact chemical form of the element in the sample.

Chapter 4

Mechanics of Manuscript Preparation

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Chapter 4

Mechanics of Manuscript Preparation

The following instructions are designed to assist secretaries, the clerical staff, and others in the preparation of copy for *in-house* NBS publications using one of the three methods of composition: electronic typesetting using in-house capability; typesetting by the Government Printing Office (GPO), by the Department of Commerce (DoC), or under a GPO contract; and typewritten camera-ready copy. Guidelines for selecting the appropriate method of composition are given in sections 3.1 and 3.2. The instructions in this section are necessarily general in nature. For style issues not answered here, see the *U.S. Government Printing Office Style Manual* or the style guides of the American Institute of Physics and the American Chemical Society available in the NBS storeroom. (See also bibliography 2-C.) Questions on individual papers and on special problems may be referred to the Technical Information and Publications Division (TIPD) and to the Program Information Office (PIO) in Boulder.

For papers submitted to outside journals, use the style manual of that journal.

4.1 Preparing Manuscript Copy for Electronic Typesetting Using In-House Capability

The use of automatic typewriters simplifies and expedites the preparation and revision of manuscript copy as it undergoes review and approval. If a manuscript scheduled for publication in an NBS series is in machine-readable form, it may be a candidate for electronic typesetting using in-house capability (see sec. 3.7.1).

The essential criterion is that the recorded form be compatible with the TIPD electronic typesetting equipment. That is, if a manuscript is recorded in one of the eight forms listed in section 3.7.1, it can be processed and converted into a typeset form by TIPD/Electronic Typesetting.

To avoid the need for any rekeyboarding by TIPD, the originating unit should be sure that the recorded form exactly matches the manuscript copy and is prepared in the same format prescribed for

manuscript copy for typesetting by GPO, by DoC, or under a GPO contract as described in section 4.2.

4.2 Preparing Manuscript Copy for Typesetting by GPO, by DoC, or Under a GPO Contract

This section describes the proper format for manuscript copy that will be processed for electronic typesetting by TIPD or will be copy edited by TIPD for typesetting by GPO, Commerce, or under GPO contract. Though not intended as camera-ready copy (see sec. 4.4), the manuscript copy should be cleanly typed. Errors, if any, should be neatly corrected on the manuscript copy, and, if the material is also being provided in machine-readable form for in-house electronic typesetting (see sec. 4.1), the automated form must be corrected to agree with the manuscript.

Use manuscript paper, Form NBS-156, type double spaced, and on one side only, beginning each page with a new paragraph. Page 1 begins with the title and author's name(s) centered, followed by the organizational affiliations and mailing address. (The affiliation and address may be omitted here if the manuscript is for a separate, monograph-type document.) The abstract and key words follow, and the text begins on this same page. (See exh. 4-A for a sample first page and sec. 4.4.4 for guidance on front matter, if any.)

Equations are centered on the page and separated from the text by triple spacing above and below. If equations are numbered, place the number in parentheses at the right-hand margin. When referring to an equation by number in the text, write out the word "equation" only when it begins a sentence; otherwise, abbreviate it as "eq" with the number of the equation following in parentheses.

Tables, figure captions, and lists of references are typed on separate sheets because the printer sets them separately.

A footnote is typed at the bottom of the page where it is referenced, separated from the text by a short rule.

Except for the special requirements mentioned above for preparing manuscript copy for typesetting (i.e., double spacing, full paragraphing, etc.), the camera-ready copy guidelines in section 4.4 will also be useful.

4.3 Preparing Manuscripts for the *Journal of Physical and Chemical Reference Data*

Certain special instructions apply to this journal; consult the NBS Office of Standard Reference Data for details.

4.4 Preparing Typewritten Camera-Ready Copy

The person preparing typewritten camera-ready copy must exercise considerably more care than is required when preparing manuscript copy for typesetting as described in section 4.2. Camera-ready copy must be clean, error-free typed copy of the entire document, including a bibliographic data sheet. Transparent mending tape should never be placed over any portion of the image area. Because negatives for reproduction are made directly from this typewritten copy, the graphic quality of the final publication will be enhanced if the procedures in the following sections are adhered to.

4.4.1 Paper and Typewriter Requirements

If the publication is less than 50 pages, reduction paper (Form CD-135 and 135B) or NBS manuscript paper (Form NBS-156) may be used. However, publications longer than 50 pages should usually be typed for "camera-ready" reduction. For a 12-pitch (elite) typewriter, 16 percent reduction paper (CD-135) is usually most desirable, and the "Letter Gothic" element is recommended. For a 10-pitch (pica) typewriter, 25 percent reduction paper (CD-135B) is permissible, and the "Delegate" element is recommended. The "Symbol 12" element is satisfactory for all symbols, superscripts and subscripts. All of the special paper (manuscript and reduction) listed in this section can be found in the NBS storeroom.

4.4.2 Two-Column and Single-Column Copy

If the majority of the text of the publication is straight copy (e.g., very few figures, equations, or tables) the publication may be typed in two-column format; that is, two columns of equal length per page. Two-column copy usually makes a more

visually appealing and more readable publication than single-column copy. A special consideration for two-column copy is the placement of figures and tables (see secs. 4.4.15, 4.4.16, and exh. 4-C).

In cases where the text is more complex the publication may be typed in single-column format across the full width of the paper (see exh. 4-B).

4.4.3 Spacing

All final copy should be single spaced with double spacing between paragraphs, except those papers with technical material requiring more than two levels of spacing. In these cases, the text may be typed space and a half. When in doubt, consult with TIPD production personnel. In Boulder, consult with PIO personnel.

The first line of each paragraph may be flush left, or indented five spaces from the left margin. Other spacing requirements are discussed in the following sections and are also illustrated in exhibits 4-B and 4-C.

4.4.4 Front Matter

When preparing copy for publications, the suggested order of the front-matter elements is: cover, title page, foreword, preface, and table of contents (with a list of tables or figures, if essential to understanding or using the paper). Use lowercase Roman numerals to identify the page number of these elements (see also sec. 4.4.17) and make sure that the table of contents exactly matches the headings, subheadings, and page numbers in the text (see exh. 4-D for sample table of contents).

Generally, the typewritten copy for the cover as well as the title page will be converted to phototype (or typeset) by TIPD or PIO Boulder. When appropriate, TIPD or PIO will also prepare the bibliographic citation information for the reverse side of the title page.

Covers and front matter for NBS in-house publications are further discussed in section 4.5.

4.4.5 Title

On page 1, the title of the paper should be centered 25 mm (about 1 in or 6 lines) below the blue line at the top of the page and typed in capitals and lowercase. If the title is long, it should be broken into two or three separate lines, single spaced, and centered. Do not underline the title or place a period at the end of it (see exhs. 4-B and 4-C).

4.4.6 Author's Name

The author's name should be centered on a single line, two lines below the title of the paper. The organizational affiliation (kept to a minimum), city, state (Postal Service abbreviations preferred), ZIP code, and country (if needed) should be centered

two lines below the author's name and single spaced. Superscript footnote references may be used to give added information including additional organizational identity, if really needed (see sec. 2.2.9, exh. 4-B, or exh. 4-C).

4.4.7 Abstract

The abstract is typed on page 1, two lines below the author's affiliation. Do not place a heading above the abstract. Both margins of the abstract should be indented five spaces, with the first line of the abstract flush left or indented an additional five spaces, consistent with the body of the text. The abstract should be no longer than 200 words (see exh. 4-B or 4-C).

Each paper for proceedings of a conference should include an abstract typed on the first page as above. The overall abstract for the proceedings is a part of the front matter and usually follows the foreword and preface, if any.

4.4.8 Key Words

Double space after the abstract and type the key words or phrases. These range from 6 to 12 in number and should be single spaced, alphabetized, and separated by semicolons as shown in exhibits 4-B and 4-C.

Except for the heading *Key words*, only proper nouns should be capitalized.

4.4.9 Headings

For ease in typing camera-ready copy, it is recommended that all headings be flush left, capitals and lowercase. However, the indentation style for headings and subheadings may also be used, so long as they are consistent throughout the paper. Make headings and the degree of subordination easily identifiable. Numbering of headings is helpful for reference purposes, but is not required for all papers.

When numbering headings and subheadings, use Arabic numerals. Main headings are numbered 1., 2., etc. Double space between the headings and the text. Subheadings are numbered 1.1, 1.2, ... 2.1, 2.2, etc. If these subheadings have additional subheadings, they are numbered 1.1.1, 1.2.1, ... 2.1.1, 2.2.1, etc. If these in turn must be subdivided, numerals in parentheses are recommended.

If authors and editors prefer a different enumerating system, headings and subheadings can be in outline form, e.g., primary headings 1., 2., 3., etc. secondary headings A., B., C., etc., tertiary and succeeding headings (1), (2); (a), (b), etc.

4.4.10 Acknowledgments

Acknowledgments, when appropriate, should be the last section of the text, following the summary or conclusion and preceding the references and appendixes. This section should be separated from

the last line of text by three lines of spacing, a centered rule 25 mm (about 1 in), and another three lines of spacing (see exh. 4-B or 4-C).

Sponsorship (financial support) is usually acknowledged on the title page or as a footnote on the first page of the paper.

4.4.11 References

Bibliographic data of the types of works most likely encountered are given in this section. The citations conform to the comprehensive reference style in the *American National Standard for Bibliographic References* (Z39.29-1977), which is available in the NBS storeroom. It is recommended that the comprehensive reference style be used if possible. (Of course, non-NBS publications may use different styles, which should be followed when papers are prepared for such publications.)

Consistency in the referencing method and in the ordering of bibliographic data is essential within a paper. Exhibit 4-E shows some specific examples for various types of references, including NBS publications. Note that the authors' names are given first, and that each author's last name precedes the first name or initials. In citing publications in a foreign language, always give the untranslated title; however, the translated title may follow the original title.

Reference numbers in the text should be enclosed in square brackets on the line. The references as typed in the reference section of the publication should also have the numbers enclosed in brackets.¹ The order of arrangement in the citation for various published media should be as follows:

(1) For journal articles, citations should be in the following order:

authors' names
title of article
title of periodical
volume number
issue number
inclusive page numbers
date of publication

See examples [1] and [2] in exhibit 4-E.

(2) For books, citations should be in the following order:

authors' names
title of book
place of publication
publisher
date of publication
number of pages

See examples [3] through [13] and [15] in exhibit 4-E.

¹For an alternative method, see section 2.20.3

(3) For chapters of books, citations should be in the following order:

- authors' names
- chapter title
- book title
- editor of book
- place of publication
- publisher
- date of publication
- pages of chapter cited

See example [16] in exhibit 4-E.

(4) For conference proceedings, the citations should be in the following order:

- authors' names
- title of paper
- editor of entire proceedings
- conference or proceedings title
- date of proceedings
- place of proceedings
- place of publication
- publisher
- date of publication
- pages of paper cited

See example [17] in exhibit 4-E.

4.4.12 Appendixes

Appendixes follow the acknowledgments and the references. Appendixes may or may not have headings like the other sections of the text. If desired, they may simply appear as Appendix A, Appendix B, etc. It is recommended that page numbering of the appendixes be consecutive with the rest of the report. Appendixes and their titles should be cited in the table of contents.

4.4.13 Footnotes

Footnotes should be numbered consecutively in the text by placing a superscript Arabic numeral directly after the item(s) to which the footnote applies. The numbered footnote is typed at the bottom of the same page, separated from the text by a short rule.

Footnoted items in tables are shown by raised lowercase letters directly after the item(s) concerned. For example, a footnoted value would read:

001 002 003^a

The footnote should appear at the bottom of the table as:

^a Extrapolated value.

Footnote examples are shown in exhibits 4-A, 4-B, and 4-C.

sections 4.4.12-4.4.16

4.4.14 Equations

Equations should be typed. If equations are numbered, number them consecutively and place the number for each in parentheses at the right margin. Refer to equations in the text as eq (1), etc., but spell out the word "equation" when used at the beginning of a sentence. Triple space above and below all equations. Center equations by lining them up on the equal (=) sign or other common symbol. Break a long equation at the end of an expression, and line up to the right of the equal (=) sign (see exhs. 4-A, 4-B, and 4-C). Press type (available in the NBS storeroom) should be used for the larger mathematical symbols such as integral signs, and for large brackets and parentheses. For more detailed information, see the *U.S. Government Printing Office Style Manual or Technical Typing* by M. A. Kurtz (on file in TIPD).

4.4.15 Tables

Tables should be typed directly as part of the text, separated from the text above and below by triple spacing. They should be numbered consecutively in Arabic, followed by a period. The table title (only first word and proper nouns capitalized) should follow the table number, on the same line. Table titles should be single spaced and centered two lines above the table. Avoid vertical and horizontal lines wherever spacing can be used effectively. See section 4.4.13 for guidelines for handling footnotes in tables.

When a paper has been prepared in two-column format and a table that spans both columns is to be included, the table should be at the top or bottom of the page whenever possible. If it is necessary that the table appear in midpage, the text that reads down the left column to the table should continue to be read in the same column below the table. The text then continues at the top of the right column (see exh. 4-C). The word "table" should be spelled out in the text in all lowercase letters except at the beginning of the sentence.

4.4.16 Figures

Drawings and photographs should be originals or glossy prints. The size of lettering on illustrations should be of such a size to be readable when reduced.

Photocopies, ozalids, halftone clippings from magazines, and pencil drawings are not acceptable. Color photographs may be used if the intent is to have them reproduced in black and white. Special approval is required from the Joint Committee on Printing through the DoC Office of Publications prior to printing if the photograph is to be reproduced in color (see sec. 3.10).

The word “figure” is to be spelled out in the text in all lowercase letters except at the beginning of a sentence. If it appears in parentheses followed by a number, it is to be abbreviated as: (fig. 1).

Several figures may appear on the same page, if practical. However, if a figure is large and reduction is impractical, it may be planned for a full page. For shorter papers, figures may be assembled at the end of the paper. Where a figure appears on the same page as text, it should, whenever possible, appear at the top or bottom of the page. When it must appear in midpage, it should be separated from the text by triple spacing both before the figure and after the figure caption. The figure caption (only first word and proper nouns capitalized) should be centered and typed single spaced two lines below the figure as shown in exhibits 4-B and 4-C. Figures should be numbered consecutively in Arabic followed by a period.

When a paper has been prepared in a two-column format, and a figure that spans both columns is placed in the middle of the text, the text should read “through” the figure. That is, the text that reads down the left column to the figure should continue to be read in the same column below the figure. The text then continues at the top of the right column (see exh. 4-C).

Foldout illustrations should be avoided. Such use increases the cost of printing, collating, and binding and lengthens the time required for final printing and delivery. If a foldout is an absolute requirement, contact TIPD (in Boulder, PIO) for placement and pagination instructions.

4.4.17 Page Numbers

The front matter of a publication consisting of those pages that precede the actual text (i.e., title page, its reverse side, foreword, preface, table of contents, lists of figures or tables) are assigned lowercase Roman numerals beginning with “i” centered at the bottom of the page. Some front matter pages are not numbered even though they are counted. Examples of such pages would include the blank backs of any pages.

The actual text pages should be numbered consecutively in Arabic throughout the body of the report (i.e., 1, 2, 3, etc.). On rare occasions and for special reasons, however, the chapters or sections may be individually numbered (i.e., 1-1, 1-2, 1-3, etc., 2-1, 2-2, 2-3, etc.).

Manuscript paper (Form NBS-156), 16 percent reduction paper (Form CD-135), and 25 percent reduction paper (Form CD-135B) have, centered near the bottom of the page, a blue box or line indicating where the page number must be consistently placed. If these papers are not available and plain bond paper is used, plan an image area (including page number) that is (a) 150 mm x 220 mm (6 in x 9 in) for manuscript paper (Form NBS-

156), (b) 191 mm x 270 mm (7 3/4 in x 10 1/2 in) for 16 percent reduction paper (Form CD-135), or (c) 220 mm x 300 mm (8 3/4 in x 12 in) for 25 percent reduction paper (Form CD-135B).

4.5 Covers and Front Matter for NBS Publications

The covers for NBS in-house publications receive special attention by the NBS production staff working closely with authors and editors. They are designed in keeping with the nature and purpose of the publications and, in the case of some NBS nonperiodical series, to provide a continuity and family appearance for specific subject matter programs. Authors are encouraged to provide appropriate and meaningful art work that can be considered by the production and graphic staffs for use in cover designs.

NBS covers must of course conform to the guidelines prescribed by the Department of Commerce and the Joint Committee on Printing. Additional information on covers and front matter is given in the *DoC Handbook of Publishing and Printing*, which is available from TIPD and PIO. For convenience and ready reference, a part of chapter 5 of this Handbook is reprinted below:

A reader's first impression of a publication comes from its cover. Covers should be designed in keeping with both the purpose and inside appearance of the publication. Their physical specifications are dictated by considerations of size of the publication, intended use, and audience. Covers fall into two main categories, self and separate.

Self-Cover Publications (Ed. Note: seldom used at NBS)

These publications are printed from front to back on the same paper stock. Usually they are short, although they may run to more than 100 pages when heavy or prolonged use is not contemplated. Separate covers of heavier stock can seldom be justified for any publication with 16 or fewer pages.

Self-cover publications are paginated throughout in Arabic numerals, with the cover considered page 1.

A self-cover publication needs no title page. Pages 1 (cover) and 2 include the publication's title, series identification if any, credit lines of the Department and operating unit, Department seal,

publication date, and for-sale line. The title, credit line of the Department, and Department seal must appear on page 1. Sometimes a table of contents and a brief foreword are also included on pages immediately following.

A variation that lends itself to periodicals and series publications and permits text to begin on page 1 is the use of a masthead across the top of the page giving title, publication date, and other identifying information. Additional information may appear in a box at the bottom of page 1 or elsewhere in the publication.

Separate-Cover Publications

These include books and booklets, generally of more than 16 pages, with covers heavier than the stock used for the text. If they are at least 1/4-inch thick, a printed backstrip reading from top to bottom is normally required.

A separate-cover publication carries its title and "U.S. Department of Commerce" on the front cover and title page. The Department seal and/or the name of the operating unit may appear on the front cover also. If the Department seal is not on the front cover, it must appear on the title page, or inside of the front cover when this occasionally serves as a substitute for the title page. The date of publication may appear on the front cover, and must always appear on the title page, or inside front cover when it is a substitute for the title page (Ed. Note: or on back cover).

Most separate-cover publications require a title page, although some special-purpose publications with separate covers can incorporate all documenting information on the front cover and inside of the front cover, and go directly into text.

The "front-matter" pages of a separate-cover publication are numbered in Roman numerals, either small capitals or lower case, with the title page as "i." The first page of text is numbered Arabic "1" and always is a right-hand page.

The order of front matter is fairly well established. A typical arrangement:

- i. Title page—series, title, author's name when used, Department seal if it does not appear on the front cover, issue date, Department and Secretary, operating unit and its chief, and for-sale line if not carried elsewhere.
- ii. Blank, or bibliographic notes if any, Library of Congress catalog card number and/or full Library of Congress citation, for-sale line if not carried elsewhere.

- iii. Letter of transmittal or foreword by an officer. (Ed. Note: At NBS, the NBS Director, an MOU Director, or other senior official.)

- iv. Continuation of foreword or transmittal letter, or blank. (Ed. Note: At NBS, the preface, if any.)

- v. Contents immediately followed by list of tables or illustrations. (Ed. Note: At NBS, the abstract and key words are generally included on page 1.)

An introduction by the author is treated as the first chapter of text and therefore is numbered in Arabic, beginning with 1. Right-hand pages are always odd-numbered; left-hand pages are even-numbered.

Case-bound books are separate-cover publications utilizing cloth- or paper-covered board or semiflexible covers. They are limited to permanent reference volumes or handbooks subject to rough treatment. A case-bound book must always have a separate title page. Case binding generally adds about 4 weeks to production time and about \$1.50 per book to cost.

Special bindings such as those employing rings, spirals, or plastic combs, or with pockets inside the covers, require special justification based on their intended use.

Publication Date Must Appear

Every Commerce Department publication going to the public, including promotional fliers and publication order forms, must carry a publication date. This is the date when the publication is officially released to the public. Without this a reader may not be able to tell how current the content of the publication is. For proper placement of date, see under "Self-Cover Publications" and "Separate-Cover Publications."

4.5.1 Interagency/Internal Reports (NBSIRs)

The reproduction of covers and front matter for the NBSIR series is handled by Gaithersburg or Boulder Printing and Duplicating. The formats for NBSIR covers and title page, shown in exhibit 4-F, are the same as those prescribed in the previous Manual, *NBS Manual for Scientific and Technical Communications* and are based on Government-wide procedures, embodied in *American National Standard Guidelines for Format and Production of Scientific and Technical Reports* (Z39.18-1974), available from the NBS storeroom.

Unless otherwise prescribed by the sponsor, NBS authors should follow the cover and title page formats given in exhibit 4-F. As with other NBS in-house publications, the Bibliographic Data Sheet (Form NBS-114A), must be completed and included as the *last page* of an NBSIR. A sample Form NBS-

114A is shown in exhibit 4-G. The alphanumeric designation for this series is assigned by the Editorial Review Board (ERB) after approval. This number is entered as Item 1 on Form NBS-114A, or as Item 2 if the sponsor's designation is given as Item 1.

Exhibit 4-A. Sample Manuscript Copy for Typesetting

INSTRUCTIONS: First line of type must touch top blue border. See NBS Forms Catalog, Forms Facsimiles Section, for instructions as to when and how to use this paper.

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Generators for Discrete Polynomial L_1
Approximation Problems
P. Domich,* J. Lawrence,** and D. Shier*
National Bureau of Standards, Washington, DC 20234

Polynomial approximation problems represent a class of specially structured problems which are frequently encountered in empirical curve-fitting. Two generators for creating such problems have been developed, implemented and used in the testing of discrete L_1 approximation codes. Both generators permit automatic generation problems with specified characteristics and (for one generator) having known, unique and controllable solutions.

Key words: algorithm testing; approximation; computational experiment; least sum of absolute deviations; polynomial approximation; test problems.

1. Introduction

Recent years have seen increased interest in least absolute deviation (L_1) data fitting, either as an alternative to or in conjunction with the usual least squares approach [1-2].¹ Estimation in the L_1 norm has certain desirable statistical properties.

*Operations Research Division, Center for Applied Mathematics, National Engineering Laboratory.
**NRC-NAS Postdoctoral Research Associate, 1973-1974.
¹Numbers in brackets indicate literature references at the end of this paper.

Form NBS-156

1 ← PAGE NO

- ① Use manuscript paper, Form NBS-156, double space, one side only, and begin each page with a new paragraph. Use same format for manuscripts that will be copy edited for electronic typesetting by TIPD or by GPO (see secs. 4.1 and 4.2).
- ② Center title and author(s) as shown. Begin about 6 lines below blue line. Note that special symbols are used to identify footnotes to front matter and that Arabic numbering begins with main text ⑦.
- ③ Keep organizational affiliation to a minimum and give mailing address. Note that additional identity, if needed, is given in a footnote (see sec. 2.9.2 for further instructions).
- ④ Indent abstract and key words as shown; list key words in alphabetical order, separate by semicolons, and capitalize only proper nouns. First line of abstract may be indented or flush.
- ⑤ Flush left all headings. Use Arabic numbers 1., 2., etc. for main headings. 1.1, 1.2, . . . 2.1, 2.2, etc. for subheadings (see sec. 4.4.9 for alternative method).
- ⑥ Begin and end each page with a paragraph (i.e., do not split a paragraph). First line may be flush left if consistent throughout.
- ⑦ Place superscript Arabic numbered footnotes at the bottom of the page.
- ⑧ Use short rule line to separate text from footnotes.
- ⑨ Center page number in blue box of Form NBS-156 as indicated.
- ⑩ Center equations and number them consecutively at the right margin in parentheses if referred to in the text.

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The two generators for polynomial approximation problems discussed here will, for specified n and m , produce the following test problem data:

$$X = \{x_{ij}^j\}, i = 1, \dots, n; j = 0, \dots, m, \quad (1)$$

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y and each of $m + 1$ independent variables z_0, \dots, z_m find parameters β_0, \dots, β_m that minimize

$$\phi = \sum_{i=1}^n y_i - \sum_{j=0}^m \beta_j z_{ij}$$

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INSTRUCTIONS: First line of type must touch top blue border. See NBS Forms Catalog, Forms Facsimiles Section, for instructions as to when and how to use this paper.

11

Table 1. Functions and their intervals of approximation

$f(x)$	$I=[a,b]$
1. $e^{-x} \sin x$	[0,4]
2. $e^{-x} \sin x$	[0,4]
3. $e^{x \sin x}$	[0,7]
4. $e^{2x}/2x$	[.05,1]
5. $75x/[1 + (7.5x)^2]$	[0,2]
6. $10xe^{-.5x}$	[0,4]
7. $1/[1 + (x - 2.5)^4]$	[0,5]
8. $x^{1/3}$	[-1,1]
9. $x^{1/2}$	[0,1]
10. $1/[1 + x^4]$	[-2.5,2.5]

11 Type tables, figure captions, and list of references on separate pages (see exh. 4-E for guidance on reference citations).

Note: Refer to section 4.3 and exhibit 3-B for guidance on elements common to all manuscript copy.

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5. References

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- [1] Abdelmalek, N. N. An efficient method for the discrete linear L_1 approximation problem, Mathematics of Computation, Vol. 29, (1976), 844-850.
- [2] Appa, G.; Smith, C. On L_1 and Chebyshev estimation, Mathematical Programming, Vol. 5 (1973), 73-87.
- [3] Armstrong, R. D.; Frome, E. L. A comparison of two algorithms for absolute deviation curve fitting, Journal of the American Statistical Association, Vol. 71, No. 354 (1976), 328-330.
- [4] Barrodale, I.; Roberts, F. D. K. An improved algorithm for discrete L_1 linear approximation, SIAM Journal on Numerical Analysis, Vol. 10, No. 5 (1973), 839-849.
- [5] Timan, A. F. Theory of Approximation of Functions of a Real Variable, trans. by J. Berry, MacMillan Co., New York, 1963.

Exhibit 4-B. Sample of Single-Column, Typewritten Camera-Ready Copy

Form CD-135

GUIDE SHEET FOR 16% REDUCTION, 8" x 10 1/2" TRIM SIZE

1 National Bureau of Standards Special Publication 561, Proceedings of the 10th Materials Research Symposium on Characterization of High Temperature Vapors and Gases held at NBS, Gaithersburg, MD, September 18-22, 1979.

2 A Comparison of Spectroscopic Flame Temperature Measurements

3 Na-D Line Reversal, Rotational and Vibrational Raman, and OH Absorption

4 M. C. Drake,* L. M. Graessle,** and J. S. Hastie**

5 National Bureau of Standards
Washington, DC 20234

6 Different spectroscopic methods are used for the measurement of flame temperature. This report compares measurements of temperature profiles for atmospheric premixed $H_2/O_2/H_2$ laminar flames using the methods of: (1) Raman scattering (H_2 , vibrational and rotational temperatures), (2) line reversal (D-line of Na, electronic temperature), and (3) line ratio (OH, rotational temperature). Two separate burner designs are considered. To obtain the most accurate comparison possible, all measurements were made with the same burners and auxiliary gas-fed system. The theory for each technique is summarized and the sensitivity, accuracy, and convenience are compared. Necessary corrections are discussed. In general, the results indicate very good agreement (better than 98%) between the various methods for certain combinations of flame composition and burner type.

7 Key words: combustion; equilibrium; high temperature; isolation; lasers; mass; spectrometry; matrix; modeling; vapors.

8 1. Introduction

9 1.1 Status of Flame Temperature Measurement

Temperature, and its spatial and temporal distribution, is perhaps the most important fundamental quantity for characterization of a high temperature vapor or gaseous system. This is especially the case for atmospheric pressure flames, where both laboratory and industrial systems are included. For instance, temperature can be used as a rating parameter for comparing the effectiveness of various control measures in combustion efficiency and flame inhibition [1].¹ More commonly, temperature is used in conjunction with species concentration data to define the kinetic or thermodynamic state of the flame [2,3].

The recent development of computer-based methods of temperature calculation for both equilibrium [4] and non-equilibrium [5] flame systems, together with the availability of an

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**Chemical Corrosion Division, National Measurement Laboratory.

Numbers in brackets indicate the literature references at the end of the paper.

1 Use manuscript paper, Form NBS-156, 16 percent reduction paper, Form CD-135 (as in this example), or 25 percent reduction paper, Form CD-135B. Type single space, or 1 1/2 spaces for technical text, exercise great care to produce clean, error-free copy (see sec. 4.4 for additional instructions).

2 When preparing a proceedings paper for which reprints will be produced (as in this example), identify the proceedings at the top of the first page of each paper.

3 Center title and authors and space as indicated.

4 Keep organizational affiliation to a minimum and indicate mailing address. Note that additional identity, if needed, is given in a footnote (see also sec. 2.9.2). Also note that special symbols are used to identify footnotes to front matter and that Arabic numbering begins with main text 8.

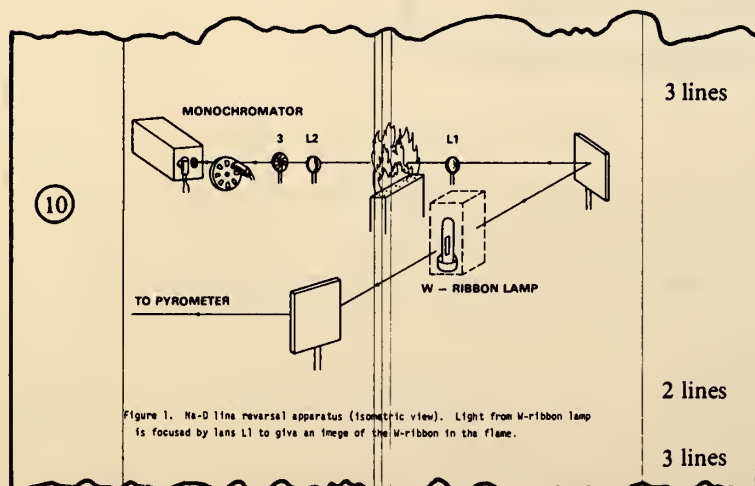
5 Type abstract two lines below author's affiliation, indented five spaces from both margins. First line may be indented five spaces or flush according to text.

6 Place key words as shown in alphabetical order, separated by semicolons. Capitalize only proper nouns.

7 Flush left is recommended for headings, upper and lowercase. Use Arabic numbers 1., 2., etc. for main headings, 1.1, 1.2, . . . 2.1, 2.2, etc. for subheadings. Double space between headings (see sec. 4.4.9 for further information and alternative method).

8 Place superscript Arabic numbered footnotes at the bottom of the page; note that a short rule separates the footnotes from the text.

9 Center page number as indicated (see sec. 4.4.17 for numbering of front matter and use of plain bond paper).



11 With the reasonable assumption that Kirchhoff's law applies here, a temperature sensitivity can be defined. Re-arranging relationships in eq (1):

$$1(\lambda, T_R) + A(\lambda, T)[1(\lambda, T) - 1(\lambda, T_R)] \approx 1(\lambda, T_R)$$

Close to reversal, the expression in the square brackets is

$$\left[\frac{d1(\lambda, T)}{dT} \right]_R dT_R \quad (2)$$

where $dT = T - T_R$.
We shall define the derivative as the temperature sensitivity.

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Form CD-135

GUIDE SHEET FOR 16% REDUCTION 8 x 10 1/2 TRIM SIZE

ous techniques and burners is also very good and indicative of the reliability of the experimental approach.

Table 2. Flame temperature comparisons^a

Initial mole ratio $M_2/O_2/M_1$	Argon shield	Na-O line reversal	OH absorption	Vibrational Raman	Rotational Raman	Calculated adiabatic
4.0/1.0/4.0	no	2100 ± 20		2146 ± 40		
	yes	2060 ± 20	2160 ± 40	1980 ± 40	g	2019
	--	1990 ± 20 ^c		2010 ± 40 ^c		
	--	2020 ^d				
3.4/1.0/2.0	yes	2470 ± 20	2425 ± 60	2500 ± 150 ^b	f	2545
	--	2475 ^d				

^aTemperature in degrees K measured at a height of 30 mm (cylindrical burner) or 15 mm (rectangular burner) above the burner face. Rotational Raman uncertainties are given as two standard deviations.

^bData obtained at $z = 30$ mm, $y = 0$ mm but value should be similar at $z = 15$ mm (see

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ments are required, as in flames with large amounts of air entrainment, Raman measurement are required since line of sight measurements give only an integrated average temperature.

We wish to acknowledge Dr. W. J. Miller for the loan of his Padley-Sugden-type burner, which we reproduced, and for useful discussions on the Na-O line reversal method. Dr. O. W. Bonnell assisted with the calculation of adiabatic flame temperatures and with the design of burners and gas feed systems. Mr. A. Sessom assisted with data taking and maintenance of the apparatus. Suggestions by Dr. Gary Mallard for improving the manuscript are also appreciated.

7. References

- Reuther, J. M. Measures of effectiveness and mechanisms for chemical and physical inhibition of quenched adiabatic premixed flames. Nat. Bur. Stand. (U.S.) Spec. Publ. 561(2): 1281-1314; 1979 September.
- Miller, Jr., W. J. The use of flames as media for the study of ion-molecule thermochemistry. Nat. Bur. Stand. (U.S.) Spec. Publ. 561(1): 39-66; 1979 September.
- Jensen, O. E. Chemical processes in high Reynolds number turbulent diffusion flames. Nat. Bur. Stand. (U.S.) Spec. Publ. 561(2): 1195-1221; 1979 September.

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10 Insert properly-sized line drawings and halftones directly into the camera-ready copy, or seek help from the graphics group, TlPD, or PIO. Center figure captions two lines below figure, single space, use Arabic numbers followed by a period. Refer to section 4.4.16 for further guidance; follow carefully.

11 Allow three lines above and below all equations. They should be centered, typed, and numbered consecutively at the right margin in parentheses if they are to be referred to in the text. Break large equations at the end of an expression and line up to the right of the equal (=) sign. Use presstype for the larger symbols (see also sec. 4.4.14).

12 Type tables directly as part of the text, separated by three lines. Number consecutively in Arabic, followed by a period and then the title. Indicate footnotes in the table with raised lowercase letters and place footnotes at the bottom of the table as shown (see also secs. 4.4.13 and 4.4.15).

13 Type a horizontal line below the table caption, below the column headings, and at the end of the table. Avoid unnecessary vertical and horizontal rules. Consult TlPD or PIO on large tables that cannot be inserted directly into the camera-ready text.

14 Acknowledgments are placed at the end of the text, separated by three lines and a centered rule line as indicated.

15 Use care and consistency in ordering the bibliographic data of references. Reference numbers in the text should be enclosed in square brackets and typed in the Reference Section in sequence as they appear in the text, or in alphabetical order (see sec. 4.11 for further details and exh. 4-E for different examples).

Note: Appendixes, if any, come next, with headings like other sections of the text, or as Appendix A, Appendix B, etc.

Exhibit 4-C. Sample of Two-Column Typewritten Camera-Ready Copy

<p>Form CD-135B</p> <p>GUIDE SHEET FOR 25% REDUCTION 8" x 10" TRIM SIZE</p>	<p>National Bureau of Standards Special Publication 80-1, Proceedings of the 10th Materials Research Symposium on Characterization of High Temperature Vapors and Gases held at NBS, Gaithersburg, MD, September 18-22, 1979.</p>	<p>6 lines 2 lines 2 lines 2 lines</p>
<p>A Comparison of Spectroscopic Flame Temperature Measurements Na-D Line Reversal, Rotational and Vibrational Raman, and OH Absorption</p> <p>* M. C. Drake,* L. M. Graben,** and J. S. Mastie**</p> <p>National Bureau of Standards Washington, DC 20234</p>	<p>Different spectroscopic methods are used for the measurement of flame temperature. This report compares measurement of temperature profiles for atmospheric premixed $H_2/O_2/N_2$ laminar flames using the methods of: (1) Raman scattering (N_2, vibrational and rotational temperatures), (2) line reversal (D-line of Na, electronic temperature), and (3) line ratio (OH, rotational temperature). Two separate burner designs are considered. To obtain the most accurate comparison possible, all measurements were made with the same burners and auxiliary gas-feed system. The theory for each technique is summarized and the sensitivity, accuracy, and convenience are compared. Necessary corrections are discussed. In general, the results indicate very good agreement (better than 98%) between the various methods for certain combinations of flame composition and burner type.</p>	<p>2 lines 2 lines</p>
<p>Key words: combustion; equilibrium; high temperature; isolation; lasers; mass; spectrometry; matrix; modeling; vapors.</p>	<p>1. Introduction</p> <p>1.1 Status of Flame Temperature Measurement</p> <p>Temperature, and its spatial and temporal distribution, is perhaps the most important fundamental quantity for characterization of a high temperature vapor or gaseous system. This is especially the case for atmospheric pressure flames, where both laboratory and industrial systems are included. For instance, temperature can be used as a rating parameter for comparing the effectiveness of various control measures in combustion efficiency and flame inhibition [1].¹ More commonly, temperature is used in conjunction with species concentration data to define the kinetic or thermodynamic state of the flame [2,3].</p> <p>The recent development of computer-based methods of temperature calculation for both equilibrium [4] and on-equilibrium [5] flame systems,</p> <p>*MRC-NBS Doctoral Research Associate 1977-1978; present address, General Electric Co., Research and Development Center, P.O. Box 8, Schenectady, New York.</p> <p>**Chemical Corrosion Division, National Measurement Laboratory</p> <p>Numbers in brackets indicate the literature references at the end of the paper.</p>	<p>7 together with the availability of an adequate basic thermodynamic and chemical kinetic data base [7,8], particularly for $H_2/O_2/N_2$, has added a new dimension to temperature determination. Accurate experimental flame temperature profiles are now needed to validate these computer based models of flame processes.</p> <p>On the experimental side, the use of different burners and flames by most workers is a serious impediment to interlaboratory transfer of data. It is now apparent that combustion standards are needed, particularly in the areas of burner design and flame selection. The present study is a mere beginning in this direction.</p> <p>In addition to these difficulties, little is known about the accuracy of various temperature measurement methods. With the continuing development, in recent years, of novel temperature measurement techniques, e.g., Raman scattering, Coherent Antistokes Raman Spectroscopy (CARS), and two line fluorescence, the need for accurate comparison data by established techniques such as line-reversal for validation of these methods is further indicated. Evidence</p>
<p>8</p> <p>4</p> <p>8</p>	<p>9</p>	<p>3 lines</p>

1 Use 16% reduction paper, Form CD-135, or 25% reduction paper, Form CD-135B (as in this example). See section 4.4 for further details. Type single space, or 1½ spaces for technical text, exercise great care to produce clean, error-free copy.

2 When preparing a proceedings paper for which reprints will be produced (as in this example), identify the proceedings at the top of the first page of each paper.

3 Center title and authors and space as indicated.

4 Keep organizational affiliation to a minimum and indicate mailing address. Note that additional identity, if needed, is given in a footnote at the bottom of the left column. Also note that special symbols are used to identify footnotes to front matter and that Arabic numbering begins with the main text 8.

5 Type abstract two lines below author's affiliation, indented five spaces from both margins. First line may be indented five spaces or flush according to text.

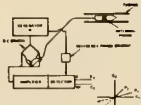
6 Place key words as shown in alphabetical order, separated by semicolons. Capitalize only proper nouns.

7 For two-column work, type up to but not beyond the blue lines on the reduction paper. Flush left is recommended for all headings, upper and lower-case. Use Arabic numbers 1., 2., etc. for main headings, 1.1, 1.2, . . . 2.1, 2.2, etc. for subheadings. Double space between headings (see sec. 4.4.9 for further information and alternative method).

8 Place superscript Arabic numbered footnotes at the bottom of the left column; note that a short rule separates the footnotes from the text.

9 Center page number as indicated (see sec. 4.4.17 for numbering of front matter and use of plain bond paper).

10 Insert properly-sized line drawings and halftones directly into the camera-ready copy, or seek help from the graphics group, TIPD, or PIO. Center figure

<p>The electromagnetic skin effect is important in any eddy current system and especially so in the multifrequency method. It is the variation of the skin effect with frequency and the resulting differences in the flow pattern of eddy currents that make it possible for the multifrequency method to produce more information about the test specimen than does the single frequency method [4].</p>	<p>2.1 Single frequency method</p> <p>A single frequency eddy current inspection device is depicted in figure 1. The single frequency generator A supplies excitation currents to the</p>	<p>3 lines</p>
<p>2. Multifrequency Eddy Current Principles</p> <p>Significant multifrequency eddy current inspection principles are:</p> <p>a. Two or more excitation frequencies are applied simultaneously to the inspection coil assembly.</p> <p>b. The filtered, demodulated outputs representing the response of the system to the different excitation carrier signals can carry independent information as a result of the eddy current skin effect which varies with frequency.</p>	 <p>Figure 1. Single frequency eddy current tubing inspection device.</p> <p>differential internal eddy current probe coils. The amplified bridge output signal is applied to an amplitude-phase detector which produced demodulated in-phase (0°) and quadrature-phase (90°)</p>	<p>2 lines 3 lines</p>

Form CD-135B

GUIDE SHEET FOR 35% REDUCTION, 8" x 10 1/2" TRIM SIZE

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the first variable on the signals d_1 , d_2 , and d_3 on lines 5, 6, and 7. Next, eqs (13), (14), and (16) can be used to determine the values of e_4 and e_5 to discriminate against two more variables. These two variables produce signals which may occupy a two-dimensional subspace of the main four-dimensional subspace of the main four-dimensional signal space which applies in this example. When e_1 , e_2 , and e_3 are determined, the signals d_1 , d_2 , and d_3 can

be found for any input signals to rotators ϕ_1 , ϕ_2 , and ϕ_3 .

$$\phi_6 = \tan^{-1} \left(\frac{e_1}{e_2} \right) s_{pq} \quad (23)$$

When the rotator ϕ_6 is set at the value of ϕ given in eq (23), the variable or parameter can be observed (when present) on line 11 (signal f_2). In

3 lines

3 lines

captions two lines below figure, single space, use Arabic numbers followed by a period. Refer to section 4.4.16 for further guidance; follow carefully.

- 11 Allow three lines above and below all equations. They should be centered, typed, and numbered consecutively at the right margin in parentheses if they are to be referred to in the text. Break large equations at the end of an expression and line up to the right of the equal (=) sign. Use presstype for the larger symbols (see also sec. 4.4.14).

Form CD-135B

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Integral fission cross sections in the ^{252}Cf fission neutron spectrum are reported with an overall

The spectral characterization of the californium-252 spontaneous fission neutron spectrum is

13

13

Table 1. Correction factors for background responses and neutron field perturbations in the cavity uranium-235 fission spectrum neutron field measurements standard cylindrical source shell

Type of Correction	^{235}U	^{233}U	^{239}Pu	^{241}Pu	^{237}Np	^{238}U	Typical associated uncertainty
Wall return background	0.8636	0.7810	0.8923	0.7995	0.9975	0.9978	± 0.1 to $\pm 0.3\%$
Photofission, epithermal and thermal neutron penetration	0.9907	0.9939	0.9840	0.9939	0.9967	0.9935	$\pm 0.1\%$
Impurity isotopes ^a	0.999	0.997	0.999	1.000	1.000	0.998	$\pm 0.1\%$
Cadmium sleeve perturbation	0.991	0.991	0.991	0.991	1.001	1.010	$\pm 1.0\%$
Instrumental	1.000	1.000	1.000	1.000	1.003	1.006	$\pm 0.3\%$
Net correction	0.8472	0.7668	0.8693	0.7875	0.9982	1.0056	± 1.05 to $\pm 1.10\%$

^aFor typical fissionable deposits

combined uncertainty of ± 2.2 - 2.8% , depending on the isotope.

excellent over the bulk of the energy range. A recent evaluation²³ of eight documented spectrom-

3 lines

3 lines

- 12 Type tables directly as part of the text, separated by three lines. Number consecutively in Arabic, followed by a period and then the title. If a table (or figure) spans both columns and appears mid page, continue left column text in same column below the table (or figure), then continue at the top of the right column. Indicate footnotes with raised lowercase letters and place footnotes at the bottom of the table as shown (see secs. 4.4.15 and 4.4.16).

- 13 Type a horizontal line below the table caption, below the column headings, and at the end of the table. Avoid unnecessary vertical and horizontal rules. Consult TIPD or PIO on large tables that cannot be inserted directly into the camera-ready text.

- 14 Acknowledgments are placed at the end of the text, separated by three lines and a centered rule line as indicated.

- 15 Use care and consistency in ordering the bibliographic data or references. Reference numbers in the text should be enclosed in square brackets and typed in the Reference Section in sequence as they appear in the text, or in alphabetical order (see sec. 4.4.11 for further details and exh. 4-E for different examples).

Note: Appendixes, if any, come next, with headings like other sections of the text, or as Appendix A, Appendix B, etc.

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time) frequency instruments. The development of automatic calibration means is needed

The permission of Battelle-Northwest and the Electric Power Research Institute to use figures 4 through 13 and the basic data given in table 1 is gratefully acknowledged. Also acknowledged are the helpful suggestions of G. J. Posakony, Manager, Nondestructive Testing, Battelle-Northwest.

6. References

- [1] McMaster, R. C., ed. Nondestructive testing handbook, Vol. II. New York: Ronald Press; 1969. Sections 36, 37, and 38.
- [2] Libby, M. L. U.S. Patent 3,229,398. January 11, 1966.

- [3] Libby, M. L. Multiparameter eddy current concepts, in Research techniques in nondestructive testing. R. S. Sharpe, ed. London: Academic Press; 1970. 345-382.

- [4] Libby, M. L. Introduction to electromagnetic nondestructive test methods. New York: Wiley-Interscience; 1971.

- [5] Haimshaw, R. Potential developments in NDT. The British Journal of Nondestructive Testing, 19(1); 21; 1977 October.

- [6] Libby, M. L.; Handling, C. R. Transformation (analyzer) device using post detector signal pattern rotators for multiparameters eddy current tester BNWL-1469. Richland, WA: Battelle-Northwest; 1970 September.

- [7] Multifrequency eddy current inspection for cracks under fasteners, AFML-TR-76-209, Battelle Columbus Laboratories, December 1976.

3 lines
2 lines

15

Exhibit 4-D. Sample Table of Contents for Typewritten Camera-Ready Copy

Note: The indentation style for headings and subheadings is used in this example, but flush left, as recommended for text, may also be used (see sec. 4.4.9).

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Exhibit 4-E. Reference Style in NBS Publications

The following are examples of how both NBS and non-NBS publications should be referenced in NBS in-house publications. When the reference style for an outside publication differs, use the style manual of that publication.

Type of Reference

As Typed on Reference Page

Journal of Research

- [1] Schoonover, Randall M. A high precision load cell mass comparator. J. Res. Nat. Bur. Stand. (U.S.). 84(5): 347-351; 1979 September-October.

Journal of Physical and Chemical Reference Data

- [2] Haar, L.; Gallagher, J. S. Thermodynamic properties of ammonia. J. Phys. Chem. Ref. Data. 7(3): 635-792; 1977.

Monographs

- [3] Burley, N. A.; Powell, R. L.; Burns, G. W.; Scroger, M. G. The nicrosil versus nisol thermocouple: properties and thermoelectric reference data. Nat. Bur. Stand. (U.S.) Monogr. 161; 1978 April. 167 p.

Handbooks

- [4] Wood, L. A.; Wood, J. F.; Krieder, K. G. Energy management for furnaces, kilns, and ovens. Nat. Bur. Stand. (U.S.) Handb. 124; 1978 January. 44 p.

Special Publications

- [5] Baum, M. A.; Washburn, S. A., eds. Science on its way to work. Nat. Bur. Stand. (U.S.) Spec. Publ. 498; 1978 April. 44 p.

Applied Mathematics Series

- [6] Clatworthy, W. H. Tables of two-associate-class partially balanced designs. Nat. Bur. Stand. (U.S.) Appl. Math. Ser. 63; 1973 May. 327 p.

National Standard Reference Data Series

- [7] Buxton, G. V.; Sellers, R. M. Compilation of rate constants for the reaction of metal ions in unusual valency states. Nat. Bur. Stand. (U.S.) Nat. Stand. Ref. Data Ser. 62; 1978 June. 78 p.

*Type of Reference**As Typed on Reference Page***Building Science Series**

- [8] Rubin, A. I.; Collins, B. L.; Tibbott, R. L. Window blinds as a potential energy saver--a case study. Nat. Bur. Stand. (U.S.) Bldg. Sci. Ser. 11; 1978 May. 85 p.

**Federal Information
Processing Standards
Publications**

- [9] McEwen, H. E. Transmittal form for describing computer magnetic tape file properties. Nat. Bur. Stand. (U.S.) Fed. Info. Process. Stand. Publ. (FIPS PUB) 53; 1978. 4 p.

Product Standards

- [10] Marking of jewelry and novelties of silver. Nat. Bur. Stand. (U.S.) Prod. Stand. 71-76; 1977 August. 4 p.

Technical Notes

- [11] Shorten, F. J., ed. NBS reactor: summary of activities July 1976 to June 1977. Nat. Bur. Stand. (U.S.) Tech. Note 969; 1978 April. 188 p.

**Consumer Information
Series**

- [12] Radack, Shirley M.; Burns, Grace G. Automation in the marketplace. Halpin, Suellen, ed. Nat. Bur. Stand. (U.S.) Consum. Info. Ser. 10; 1978 March. 8 p.

**NBS Interagency/Internal
Reports**

- [13] Stiehler, Robert D.; Hockman, Arthur; Embree, Edward J.; Masters, Larry W. Solar energy systems--standards for rubber seals. Nat. Bur. Stand. (U.S.) NBSIR 77-1437; 1978 March. 63 p.

Journal article

- [14] Dunlap, Connie F. Cataloging in publication. Lib. J. 99(18): 2573-2578; 1974 October 15.

Book

- [15] Heilbrun, James. Urban economics and public policy. New York: St. Martin Press; 1974. 380 p.

*Type of Reference**As Typed on Reference Page***Chapter in a book**

- [16] Iverson, W. P.; Brinckman, F. E. Microbial metabolism of heavy metals, chapter 8 in Water pollution microbiology, Vol. 2. R. Mitchell, ed. New York, NY: John Wiley & Sons; 1978. 201-232.

Chapter in conference Proceedings

- [17]¹ Senholzi, Peter B. Oil analysis/wear particle analysis. Shives, T. R.; Willard, William A., ed. Proceedings of the 26th meeting of the mechanical failure prevention group: detection, diagnosis, and prognosis; 1977 May 17-19; Chicago, IL. Nat. Bur. Stand. (U.S.) Spec. Publ. 494; 1977 September. 27-32.


¹[17] is an NBS publication, but the same format should be followed when referencing a proceedings not published by NBS.

Exhibit 4-F. Sample Cover and Title Page for NBSIRs

NBSIR Cover

NBSIR 80-2004	Report number (Assigned by ERB after approval)
The Measurement of the Smoke Leakage of Door Assemblies During Standard Fire Exposures	Title (Subtitle, if any)
Leonard Y. Cooper	Author(s)
National Bureau of Standards U.S. Department of Commerce Washington, D.C. 20234	Organization and address
June 1980	Date
Final Report	Type of report or period covered
Prepared for The Occupational Safety and Health Administration (OSHA) U.S. Department of Labor Washington, D.C. 20210	Sponsoring Agency and address

NBSIR Title Page

NBSIR 80-2004	Report number (Assigned by ERB after approval)
THE MEASUREMENT OF THE SMOKE LEAKAGE OF DOOR ASSEMBLIES DURING STANDARD FIRE EXPOSURES	Title (Subtitle, if any)
Leonard Y. Cooper	Author(s)
Center for Fire Research National Engineering Laboratory National Bureau of Standards U.S. Department of Commerce Washington, D.C. 20234	Organization and address (give fuller identity on title page, if needed)
June 1980	Date
Final Report	Type of report or period covered
Prepared for The Occupational Safety and Health Administration (OSHA) U.S. Department of Labor Washington, D.C. 20210	Sponsoring Agency and address
 U.S. DEPARTMENT OF COMMERCE, Philip M. Klutznick, Secretary Luther H. Hodges, Jr., Deputy Secretary Jordan J. Baruch, Assistant Secretary for Productivity, Technology, and Innovation NATIONAL BUREAU OF STANDARDS, Ernest Ambler, Director	Seal and masthead provided by NBS duplicating units

Note: Final camera-ready copy for cover and title page is prepared by NBS duplicating units from typewritten copy supplied by the originating organization. The NBS duplicating units also provide the required DoC/NBS seal and masthead information at the bottom of the title page and on the cover of "Internal" reports (sponsored only by NBS). See next page for Bibliographic Data Sheet (NBS-114A).

Exhibit 4-G. Sample Bibliographic Data Sheet for NBSIRs

NBS-114A (REV. 2-80)			
U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET (See instructions)	1. PUBLICATION OR REPORT NO. NBSIR 80-2004	2. Performing Organ. Report No.	3. Publication Date June 1980
4. TITLE AND SUBTITLE The Measurement of the Smoke Leakage of Door Assemblies During Standard Fire Exposures			
5. AUTHOR(S) Leonard Y. Cooper			
6. PERFORMING ORGANIZATION (If joint or other than NBS, see instructions) NATIONAL BUREAU OF STANDARDS DEPARTMENT OF COMMERCE WASHINGTON, D.C. 20234		7. Contract/Grant No.	
		8. Type of Report & Period Covered Final	
9. SPONSORING ORGANIZATION NAME AND COMPLETE ADDRESS (Street, City, State, ZIP) The Occupational Safety and Health Administration (OSHA) U.S. Department of Labor Washington, DC 20210			
10. SUPPLEMENTARY NOTES <input type="checkbox"/> Document describes a computer program; SF-18S, FIPS Software Summary, is attached.			
11. ABSTRACT (A 200-word or less factual summary of most significant information; If document includes a significant bibliography or literature survey, mention it here) A basis for relating overall intrabuilding smoke migration dynamics to high temperature, door assembly smoke leakage measurements is formulated. The results of applying the tentative, high temperature, ISO test method DP 5925 Part 3, which was developed to measure smoke leakage of door assemblies during the course of a standard fire endurance test, are reported. A critical analysis reveals that the basic objective of the method is limited in its utility in the sense that fire scenarios in high-rise buildings may not be adequately simulated. Consistent with the above-mentioned experimental results, troublesome theoretical problems with the test method and its procedures are identified. These lead to a conclusion that the test method as written is generally unreliable. An alternate test concept which removes the above-mentioned DP 5925 Part 3 limitation and all of its problems is described and its development is advocated.			
12. KEY WORDS (Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons) building fires; compartment fires; doors; egress; fire tests; high-rise buildings; leakage; life safety; smoke; smoke movement; stack effects; test methods.			
13. AVAILABILITY <input checked="" type="checkbox"/> Unlimited <input type="checkbox"/> For Official Distribution. Do Not Release to NTIS <input type="checkbox"/> Order From Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. <input checked="" type="checkbox"/> Order From National Technical Information Service (NTIS), Springfield, VA. 22161		14. NO. OF PRINTED PAGES 70 15. Price \$7.00	

USCOMM-DC 6043-P80

For detailed instructions for completing this sheet, see exhibit 1-E(a) or reverse side of Form NBS-114. Include this sheet as the last page of the report.

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Special Forms of Communication

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Chapter 5

Special Forms of Communication

This chapter is addressed to administrators, scientists, and engineers, and describes how to plan and coordinate special forms of communication within NBS policy guidelines.

5.1 Conferences

5.1.1 Success of Conferences

Face-to-face presentations and discussions through conferences and seminars have proved successful at NBS as a means of two-way communication with business, industry, academia, scientific organizations, and Government.

A successful meeting depends on more than program content. The proper blending of talent and personalities to stimulate original thought; the combination of staff friendliness, courtesy, and efficiency to create an easy, outgoing atmosphere; and careful conference management—all are important in conducting a successful and fruitful conference.

5.1.2 NBS Participation

In general, all technical conferences involving NBS facilities should relate to some aspect of NBS competences and interests. Whether sponsored exclusively by NBS, cosponsored by NBS in cooperation with other Government organizations or professional societies, or hosted by NBS and sponsored by a non-NBS group, some NBS technical group will be committed to participation in the conference with at least one technical representative who will be particularly concerned with the scope and coverage of the specific conference. Such participation is necessary so that NBS has a voice both in the substantive program aspects and in the arrangements.

5.1.3 Approval of Conferences

Although the conferences in which NBS is involved may appear similar in format, they require different management approaches.

Type 1. Conferences sponsored or cosponsored by the Bureau with national or international speakers and attendees, and as many as several hundred persons attending. The request originates within NBS. Approval is required at the major operating unit (MOU) level. Space and facilities are booked by the conference managers in the Public Information Division (PID), Gaithersburg, and the Program Information Office (PIO), Boulder.

Type 2. Conferences in which NBS provides the facilities and acts as host but is not listed as a cosponsor, even though NBS staff members are heavily involved in the meeting and request use of the facilities. These are usually committee meetings, e.g., committee meetings of the American National Standards Institute or the American Society for Testing and Materials. Approval is required at the MOU level. Space and facilities are booked by the conference managers in PID, Gaithersburg, and PIO, Boulder.

Type 3. Technical conferences in which NBS provides the facilities and acts as host or as an honorary cosponsor but has only a marginal interest in the program, and sponsorship of general events not directly connected with programs of the technical MOUs, such as the Montgomery Science Fair. Requests normally originate outside NBS but should be approved by the Chief of the Public Information Division. Space and facilities are booked through Conference Facilities and Equipment, after the conference has been approved. In Boulder, contact PIO.

Type 4. Small training courses or seminars sponsored by NBS, (e.g., precision measurement seminars sponsored by NBS) through internal NBS procedures. Such conferences must be approved by the NBS Director or Deputy Director. Space and other facilities are booked by the conference managers of PID, Gaithersburg, and PIO, Boulder.

Type 5. Small seminars, sponsored at the division or section level, often with a single guest speaker (e.g., solid-state physics seminars, heat division colloquia). These seminars must be approved at the MOU level, or at the center level—if the laboratory director so chooses. Such seminars should be booked directly through the staff of Conference Facilities and Equipment, who will notify PID. In Boulder contact PIO.

Type 6. Community related events and hosted events of a general nature not related to the Bureau's technical programs. These requests originate outside NBS, and are approved by the Chief, Facilities Services Division.

Following approval of the conference, a member of the NBS group that originated the request should meet with the appropriate PID or PIO staff to discuss general arrangements. The conference manager of PID or PIO should be included in any general planning meetings for the conference. When audiovisual and space requirements are discussed, the Chief of Conference Facilities and Equipment should be involved.

5.1.4 Responsibilities of Public Information Division or Program Information Office

The PID in Gaithersburg and the PIO in Boulder are responsible for the management and coordination of the NBS conference program. All conferences of types 1 through 4 should be managed by these offices. These offices can answer questions about the type-classification of a meeting. Good communication between these offices and the technical sponsor is necessary for a successful conference.

Conference management services include consulting with sponsors on:

- (1) Overall concept and direction of conference,
- (2) Promotional efforts,
- (3) Schedules and deadlines,
- (4) Agenda,
- (5) Conference financing,
- (6) Proceedings,
- (7) Displays, and
- (8) Bureau procedures for conferences.

Services also include helping arrange the following:

- (1) Food functions,
- (2) Living accommodations,
- (3) Transportation,
- (4) Printing,
- (5) Mailing,
- (6) Registration procedures and materials,
- (7) Hospitality services, and
- (8) Tours.

5.1.5 Responsibilities of Technical Organizations

Once a technical organization has received the appropriate approvals, it should be prepared to accept the following responsibilities:

- (1) Providing adequate staff for preparing meeting announcements, program documents (e.g., abstracts of papers), and proceedings of the meeting;
- (2) Processing registration;
- (3) Handling fiscal arrangements;
- (4) Providing staff to assist during the conference in such roles as registrars and bus dispatchers;
- (5) Maintaining primary liaison with cosponsors;
- (6) Overseeing the technical program, in association with any cosponsors. This responsibility includes planning the program content and style, arranging for speakers, scheduling the program, and planning pre- and post-conference material, such as abstracts and proceedings;
- (8) Assisting PID, Gaithersburg, or PIO, Boulder, as needed in the execution of other arrangements.

For conferences involving the National Measurement Laboratory (NML), additional guidelines are available from the NML office.

5.1.6 Financing

Details on conference financing are contained in exhibit 5-A.

5.1.7 Publishing Conference Proceedings

The publishing cost of conference proceedings *must* be completely covered either by including this cost as part of the attendance fee, from MOU funds, from cosponsor contributions, or a combination of these sources.

In preparing the proceedings for publication, the technical sponsor must adhere to the following editorial review procedures. Each paper by an NBS author must be individually reviewed and approved by the appropriate Editorial Review Board (in addition to being reviewed by the symposium committee). Papers by non-NBS authors must be carefully reviewed by the symposium committee or the proceedings editor (an NBS staff member appointed by the symposium committee) using appropriate review criteria.

Following editorial review of all technical papers, the conference chairperson or proceedings editor must submit the front material to the appropriate NBS Editorial Review Board for final noting and release for publication. Forms NBS-114 and 114-A should accompany the front material (which includes cover and title page copy, table of contents, abstract, foreword, introductory statements, key words, and any other front-matter elements). This final step is to ensure that the proceedings package is ready for production by TIPD.

Also, in order that "invited" conference papers by non-Government authors be subject to the same

public domain status as papers by NBS authors, non-Government authors should be asked to sign a copyright release form, a sample of which appears in exhibit 5-B. (For more information on copyright status of NBS publications, see sec. 1.4.1.)

The mechanics of publication—whether by typewriter or by typesetting—are covered in chapters 3 and 4. It is the responsibility of the conference manager (usually the proceedings editor) to provide final copy suitable for one of the three NBS methods of publication discussed in chapter 3 of this manual. When typewritten camera-ready copy is to be used, it is especially important that outside conference authors be provided with detailed instructions on the desired format for their papers. This can conveniently be done by reproducing the instructions for typewritten camera-ready copy (see sec. 4.4), and sending them to each author along with an adequate supply of 16 or 25 percent reduction paper (obtainable from the NBS storeroom). Proceedings editors should check exhibit 5-C to be sure they have fulfilled all the requirements for publication. For additional guidance, they may contact TIPD, particularly when production by typesetting is planned.

5.2 Oral Presentations

5.2.1 Review and Approval

When a staff member is invited to speak before an outside group, the Editorial Review Board (ERB) should be notified by submitting Form NBS-118 (Notice of Talk) at least 10 days before the talk is given, and 3 weeks if the talk is to be given outside of the Gaithersburg or Boulder areas, for advance notice in the technical calendar. The 3-week notification is helpful to Department of Commerce field officers if the talk is likely to draw public or press interest.

If publication of the oral presentation is contemplated, the manuscript is subject to the same review procedures as other papers. An abstract of approximately 200 words should accompany Form NBS-118 for clearance if possible (see sec. 1.3.10 and exh. 1-E(h)). Manuscripts and other material reproduced in any form for general distribution before or during a meeting, or for any other prepublication use, must be submitted to the appropriate ERB for noting and review. The manuscripts should be clearly labeled "Preliminary Draft for Discussion—Not for Publication." However, editorial review is not required if such a manuscript is distributed to a limited number of colleagues for comments.

Transcripts of tape-recorded speeches intended for publication must also be submitted for appropriate review. The transcript should be carefully

edited before submission so that it will be suitable for formal publication.

Technical papers presented at some meetings, such as those of the American Physical Society, are published only as abstracts and are submitted to sponsoring committees before the meeting. If the author finds that a sponsor's deadline does not permit prior submission to ERB, the author may mail the abstract to the sponsor before it has been approved by ERB. A copy of this abstract must, however, be submitted to ERB as soon as possible.

Some organizations publish abstracts that are in themselves short papers. Such extensive abstracts are normally treated as papers and should be given the same type of review as is given a letter to the editor (see sec. 1.3.10). If an abstract is more than 500 words, or if it contains figures, tables, or a number of references, it should be submitted with completed Forms NBS-114 and 114A to ERB the same as any other manuscript (see sec. 1.3).

5.2.2 Guidelines for Oral Presentations¹

A speech offers a good opportunity for communication of technical ideas because of the potential for an instant exchange of information between a speaker and an audience.

The challenge in giving a good talk is to introduce a technical subject to a group of one's colleagues, guide them through an analysis of the subject's relevant aspects, and show how solutions were arrived at and what they mean in as broad a context as possible.

5.2.3 Reading a Speech

A potential hazard to communication is reading a speech, especially where speakers do so to avoid the necessity of thinking on their feet. Because the audience usually realizes this, a paper, designed for printed publication, may fall flat when read aloud unless the paper has considerable literary value in addition to its scientific worth. In reading a paper, a person may fail to look at an audience often enough to maintain effective contact, to judge their reaction, and to adjust the speech accordingly.

5.2.4 Rehearsing a Speech

Whether the speech is to be delivered from notes or read, rehearsal is usually required for all but the highly experienced speaker. If the speech is to be read, rehearsal is necessary to eliminate or change sentences and phrases that do not read well, to develop a conversational delivery, and to practice

¹ Sections 5.2.2 to 5.2.7 are adapted from Hereford, Thomas G. Oral presentation of technical papers. NBS manual for scientific and technical communications. Nat. Bur. Stand. (U.S.); June 1969, 108 p.

thinking out what is being read, so that the reading will not seem mechanical. Speeches delivered from notes must be rehearsed to see how well the outline works as a guide for the speech, to smooth out phrasing, and to develop transitions between ideas as they appear in the outline.

5.2.5 Organization and Visual Aids

Any of the patterns used to present information in papers can be adapted for speeches. Some adaptation is necessary because people hearing a speech do not have a chance to look back and refresh their memory as a reader does.

A powerful tool for oral communication is the visual aid—slides, motion pictures, transparencies (with overhead projector), charts, blackboards, and models. Good visuals clarify and amplify the verbal message. They command audience attention, stimulate interest, and help the speaker emphasize major points. Visuals merit the same careful thought and preparation that go into the manuscript. If the visuals cannot be read or understood, they detract from the information they are meant to enhance.

PID, Gaithersburg, and the PIO, Boulder, are prepared to assist the NBS staff in all phases of audiovisual presentations (see sec. 5.5). In addition, the following general guidelines may help the speaker in planning and using visual aids.

- (1) Use visuals appropriate for the size of the auditorium. For example, blackboards, flip charts, or small models are too small to be effective in large auditoriums, while slides are enlarged when projected and can be seen from anywhere in the auditorium.
- (2) Slow down the rate of speaking while the visual aid is before the audience to give listeners time to read and comprehend the visual. Keep in mind that the audiences' attention is divided when a visual is presented; they must both look and listen.
- (3) Do not repeat aloud the visual word for word, but emphasize or expand this information to develop the ideas further.
- (4) Do not leave a visual on the screen after discussing its subject.
- (5) Know the slides and their sequence. Talk to the audience, not to the slides!

5.2.6 Presentation

Oral presentations require much effort both in preparation and in presentation. An hour-long speech may require a week or more in preparation, and afterward the speaker should feel that the hour of speaking was about equal in effort to a whole day of normal working.

If there is a discussion period, the speaker should discover the main point of each question and give a brief answer that will satisfy not only the questioner but the whole audience as well. Occasionally speakers may have to deal with "loaded" questions. They should usually conceal knowledge of the ulterior design of the question and proceed to give an answer so candid as to disarm the questioner. Persistent questioners should be invited to confer with the speaker after the formal meeting. (See bibliography 5-A for more guides to oral presentations.)

5.3 Exhibits

The exhibit is a unique medium for transferring information. It can combine artifacts, text, people, film, photography, publications, recordings, and participatory devices to attract diverse audiences on many levels and for a variety of reasons. An exhibit can (1) educate audiences about NBS work, (2) reach people who want and can use additional information about NBS programs, and (3) encourage participation in NBS programs. For success it requires a joint effort between the scientific, technical, and administrative staff, PID or PIO, and other specialists.

5.3.1 Developing or Refurbishing an Exhibit

When a program manager is contemplating the development of a new exhibit or the refurbishment of an old exhibit, a representative should call the exhibit manager in PID, Gaithersburg, or PIO, Boulder, to discuss the exhibit, its purpose, its intended audience, and its best format for success. Costs, logistical procedures, time factors, design and fabrication issues will also be discussed. These preliminary discussions will assist the staff member and the exhibit manager to decide what exhibits approach is best for the program, of even if an exhibit is the best way to communicate the message.

An initial meeting will be held to insure proper coordination. Attendees at this meeting will include the exhibit manager, the public information specialist who covers the organization, and the publications coordinator—all from PID or PIO; the designer, if possible; and scientific/technical division representatives. The scope and content of the exhibit, research and writing, collection of artifacts, design and production, and the activities required to produce an exhibit will be discussed.

At an initial exhibit review meeting, the representative from the scientific/technical division should have the following: (1) a written statement of the exhibit's purpose and the objectives to be obtained with the audience; (2) a description of

the audience(s) to be reached, such as professionals, lay persons (adults and students), industry, commerce, academia; (3) suggestions of possible sites in which this exhibit might be shown, such as trade shows, professional meetings, museums, fairs, science and technology centers, and schools; and (4) any written materials about the NBS scientific or technological program, which provide background information for the exhibit.

An exhibit script is the basis of an exhibit, and must be developed prior to starting the design and fabrication phases. It includes text and visuals, including artifacts, photographs, and drawings. The designer produces the design concept by working from the script and the final design is submitted to the fabricator for production. The exhibit may be evaluated to determine its ability to communicate to its designated audiences. Circulation of the exhibit will be implemented according to the guidelines below (see sec. 5.3.2).

5.3.2 Displaying an Existing Exhibit

If a program wishes to display an existing exhibit, a representative should contact the exhibit manager in PID or PIO as soon as possible for the best possible service. The exhibits program develops the exhibits' display schedule 1 to 2 years in advance.

The exhibit manager, working with the scientific/technical division representatives, makes arrangements to ship the exhibit, repair the exhibit, order supplies and services necessary at the display site, order booths for trade shows, coordinate display arrangements with the exhibit recipient, prepare and ship publications to be used with the exhibit, and staff the exhibit.

When a program plans to display only publications, the procedure outlined for existing exhibits should be followed.

5.4 Tours

5.4.1 General

The NBS tour program permits person-to-person communication of the work done at NBS. The public is invited into the science laboratory to learn about measurement technology and how standards affect the quality of everyday life. All tours are arranged to cause as little disruption to NBS scientists as possible.

In Gaithersburg approximately 4,000 visitors are guided through NBS per year. At this site public tours of general interest are scheduled every Tuesday at 1:30 p.m. and every Friday at 9:30 a.m. Group tours and special programs can be arranged upon request with advance notice. General public

tours include an NBS overview, a discussion of basic measurement exhibits in the museum, and selected laboratory visits. Special or group tours include an NBS overview, a museum stop (if appropriate), and laboratory visits that cover the interests of the group. Tours connected with conferences and VIP visits fall into this last category.

In Boulder, public tours are scheduled one morning per week in the summer. Self-guided tours are available year round.

5.4.2 Tour Logistics

Tours should be coordinated by the manager of the tour program in PID, Gaithersburg, or PIO, Boulder. The following steps are involved:

- (1) A staff member may be asked to set up a tour. If the groups are small (one to five people) and requests are general in nature, these callers can join one of the regularly scheduled general public tours.
- (2) To avoid conflicts, all offices hosting individuals or groups are asked to notify the tour manager in PID or PIO before making a commitment.
- (3) For specific tour requests, the staff contact and the tour manager assess the audience size and needs. Tentative arrangements are made until specific background information on the visitors is secured.
- (4) The tour manager suggests relevant NBS research activities as possible tour stops based on the tour manager's knowledge of NBS and the visitor's interest.
- (5) The tour manager proceeds with logistical arrangements such as the timing of the tour, transportation, meeting facilities, audiovisual equipment, and meals for special visitors or large groups.
- (6) To eliminate the necessity of technical staff members speaking to non-technical or general interest groups, PID personnel have produced a repertoire of tour stops of specific technical laboratories from which to structure diversified, meaningful tours. The tour manager will select a tour appropriate to the non-technical visitors' interests from these stops.
- (7) For visitors with technical backgrounds, the tour manager schedules laboratory speakers, when appropriate, in a time frame that is as convenient as possible for the speaker.
- (8) As a reminder to speakers, the tour manager prepares a tour agenda and sends it to all people concerned with the tour.
- (9) The tour manager follows up the tour with thank-you letters, answers requests for information, and records tour data. Periodic tour evaluations are conducted.

5.5 Audiovisual Productions

The audiovisual programs in PID, Gaithersburg, and PIO, Boulder, provide support to the technical staff and management of NBS. The audiovisual staff handles a wide variety of audiovisual requests, from editing and processing 16-mm film footage to the development of complete contract specifications for the production of a major audiovisual production. Competent technical advice is available in many audiovisual areas. These include budget development, technical monitoring of contracts and services, film editing, promotion and distribution, planning audiovisual programs, development of creative audiovisual concepts, and script writing.

5.5.1 Justifying an Audiovisual Production

Before an audiovisual program is produced, the following major steps should be taken:

- (1) Identify the need to communicate a certain message to the intended audience.
- (2) Ascertain that an audiovisual program is an appropriate means of delivery.
- (3) Determine which audiovisual format is most suitable.
- (4) Define as clearly as possible the intended audience.
- (5) Determine the costs, intended life span, and distribution involved.
- (6) Obtain clearance from the Department of Commerce to proceed with the production by submitting SEC-927 (Audiovisual Production Request).

5.5.2 Motion Pictures

NBS can coordinate the production of color or black and white films with optical or magnetic sound tracks. Costs of production vary widely depending upon such factors as research and script development, number of shooting locations, length of film, special effects, choice of original or canned musical score, and availability of stock footage.

5.5.3 Videotape

There are four basic formats available for videotape: 1/2-inch and 1-inch reel-to-reel, 3/4-inch cassette, and 2-inch reel-to-reel suitable for television broadcast. The 3/4-inch format is the most widely used, and recent advances have made it possible for the 3/4-inch cassette to be broadcast with acceptable quality.

5.5.4 Slide-Audio Productions

Slide-audio programs (slide with accompanying recorded narration) are usually less expensive to produce than film or videotape. The slide-audio program is an excellent format to use in exhibits because the equipment required is relatively inexpensive and allows remote starting and automatic stopping. Slide-audio programs can also be used for internal presentations such as briefings and overviews.

The cost for slide presentations varies according to the length of the presentation, its sophistication, the number of locations to be shot, the amount of original graphics available, and the typesetting required.

Color Slide File The PID has a comprehensive file of more than 4,000 35-mm color slides, which document visually many NBS technical program activities and the physical facilities in Gaithersburg and Boulder. Also, the NBS slide file contains general category slides of buildings, people, transportation, environment, background abstracts, and other subjects. It is a valuable resource which is available to the NBS staff for briefings, overviews, and other types of visual presentations. A similar slide file is available in PIO, Boulder.

5.5.5 Television Public Service Announcements

Television public service announcements are used to promote important messages, publications, or other types of Government products and services. Generally, agencies distribute television public service announcements to television stations as 16-mm color sound prints.

5.5.6 Radio and Audio-Only Programming

The Department of Commerce Broadcast Service has been distributing 3 1/2-minute features to radio stations for several years. Radio spots can be distributed at a lower cost than television spots, and the sound track of a television spot can also be distributed as a radio public service announcement. Thirty-second announcements will probably receive the most play, but a 60-second announcement is acceptable. There are also applications for shorter 10 -to 20-second spots.

5.5.7 Exhibit Programming

Many exhibits produced by Government agencies use audiovisuals to help convey a theme or message. Nearly any audiovisual format can be used in an exhibit with the right equipment. Films or television spots can be transferred to Super 8 film

cartridge or run automatically on a start-stop or continuous basis. This method is available also for videotape, slide-audio, and audio-only programs. Cartridge tapes can run continuously, or be operated by a remote start button and automatically stopped at the end of the program.

5.5.8 Distribution of Audiovisual Programs

Distribution of NBS audiovisual programs is either through free loans or sales. Free loans are handled by Modern Talking Picture Service, a commercial distribution firm with regional branches throughout the United States. The company publishes catalogs on a regular basis and in addition will promote specific films through specialized flyers and order forms. Modern provides the Bureau with monthly Distribution Reports which give statistical data on such things as the number of shipments, number of showings, and audience totals for a particular film.

Sales of NBS films are handled by the National Audiovisual Center, a federal agency that promotes government audiovisual programs with regularly issued catalogs.

5.6 Historical Information

The historical information program responds to inquiries of a historical nature about the Bureau, its past programs and achievements, and its distinguished staff. All such internal and external inquiries should be referred to the historical information specialist, PID, who will either assist the staff member in responding, or handle the request. The historical information specialist can help locate historic documents, museum holdings, photographs, slides, and biographical information on past and present distinguished personnel of the Bureau.

5.6.1 Museum

NBS maintains a museum designed to preserve and display apparatus and other memorabilia illustrative of the past scientific work of NBS. It provides information for visitors, inspiration for present and future staff members, and an historical resource on the evolution of the science of physical measurements.

Displays of the past achievements of NBS are contained in the Museum itself and in the lobby area adjacent to the Museum and the Library. In this lobby temporary exhibits feature items from the Museum and the Library collections.

The historical information specialist, as museum curator, is responsible for the preservation of all scientific artifacts and related information transferred to the museum custody. Artifacts on display as of November 1977 are listed in the NBS museum catalog, which is available in the Museum, in the Library, and in center and division offices.

5.6.2 Contribution of Artifacts

Members of the scientific and technical staff are urged to contact the curator to insure the preservation of artifacts in their custody that may have played a significant role in Bureau achievements. These historical artifacts, the completed museum information sheets, and related photographs and documents constitute an archives for future historical inquiries and exhibits.

5.7 Community Outreach

This program encourages NBS scientific and technical staff members to make hour-long presentations to public school students in the 4th through the 12th grades. The purpose of the program is to expose a great many young people to science and technology, and to stimulate more minorities and women to consider science-related careers.

This program is coordinated by the Public Information Division, Gaithersburg, and by the Program Information Office, Boulder.

The Science and Technology Enrichment Program (STEP), a cooperative venture with the Montgomery County (Maryland) Public Schools, and NBS, Gaithersburg, enhances the learning experiences of students who are academically gifted, talented and interested in the sciences. The Career Awareness and Resource Education (CARE) Program is designed to stimulate awareness of careers in math and science, particularly among females, minorities and handicapped students in several Colorado school districts, including Denver, Boulder, and Adams County.

In addition, the Community Outreach Program in Gaithersburg plans career awareness days for eighth and ninth grade students, and both programs respond to requests for speakers and resources that come from additional educational institutions.

NBS staff members who are interested in participating in either the STEP or CARE activities, or who receive requests from a school or school system should contact PID in Gaithersburg, or PIO in Boulder for information and/or coordination of efforts.

Exhibit 5-A. Conference Financing

1. Purpose

This section states the policies and procedures to be followed in the conduct of Bureau-sponsored, fee-supported conferences.

2. Definition

For the purpose of this section, the term "Bureau-sponsored, fee-supported conference" includes any form of meeting, seminar, symposium, or training session, sponsored, cosponsored, or hosted by NBS where a registration (or participation) fee is established. The finances may be handled through the NBS accounting system, or by a cosponsor, the conference, or an NBS employee.

3. Approval Authorities

a. The following are authorized to approve Bureau-sponsored conferences when costs *are* to be paid through the Bureau accounting system:

- Director
- Deputy Director
- Director, NBS Boulder Laboratories

This authority may not be redelegated.

b. The following are authorized to approve Bureau-sponsored, fee-supported conferences when costs *are not* paid through the Bureau accounting system:

- MOU Director
- Director, NBS Boulder Laboratories

c. Separate approval is required for each conference even though it may be a continuation or periodic reconvening of a previously approved conference.

4. Use of Fees

Registration fees are used to offset partially or wholly the cost to the Bureau of providing a special service to a select group, i.e., the conference participants. In the case of nonrecurring conferences, any balance left after obligations are liquidated will be deposited in the Gift and Honorarium Fund.

5. Allowable Expenses

a. Costs of the following items should be included in calculating the income required from fees and contributions: printing and duplicating, including printing of proceedings; travel and local transportation; communications; rental of equipment and fixtures; rental of non-NBS conference

rooms; other costs usually associated with conferences. When costs are handled through the Bureau accounting system, the time of Bureau employees and related overhead should be charged to the conference cost center, and temporary help such as typists and registrars may be appointed through regular personnel channels (they may not be hired on purchase orders).

b. Serving refreshments during conference breaks, holding luncheon meetings, receptions, and banquets, or arranging special events for the spouses of participants are frequently conducive to the success of a conference. If such functions are considered necessary to accomplish the objectives of the conference, it is necessary to include the incremental costs of the functions in the registration fee. Permission to charge the costs of these ancillary functions against conference income must be included in the request for approval of the conference whether or not the costs are paid through the Bureau accounting system. The *only* other methods of paying for these functions are through use, after advance clearance, of gifts and bequests funds (see *Administrative Manual*, Subchapter 8.03, Official Entertainment), or by having registrants pay out-of-pocket. Appropriated funds may not be used to pay these costs.

c. The cost of alcoholic beverages may not be included in registration fees when the costs are paid through the Bureau accounting system.

6. Recovery of Costs Paid Through Bureau Accounting System

Each division will be expected to fully recover all costs charged against cost centers established for conferences. To the extent that fees fall short of actual costs incurred, the division is expected to arrange with the Office of the Comptroller to have the cost deficit transferred to other projects in the division that benefited from the conference.

7. Financial Advice and Assistance

For advice and assistance concerning financial arrangements, contact the Budget Office. (In Boulder, contact the Fiscal Office.)

8. Procedures, Costs Handled Through the Bureau Accounting System

a. Divisions planning to hold Bureau-sponsored, fee-supported conferences where costs will be paid through the Bureau accounting system should submit a memorandum (original and four copies) to the appropriate official listed in 3a through their MOU director. The request should give the following pertinent information concerning the conference: starting and closing dates, location of the

various functions, number of participants and the types of organizations the participants will generally represent, the proposed fees to be charged, and whether refreshments as described in 5b are included in the fee. The cost of alcoholic beverages may not be included in the registration fee. A separate cost center in the 580-584 series must be established to collect fees and costs associated with each conference.

b. The official who approves the conference will return the original signed copy to the initiating division through the MOU director, forward one copy to PID, and one copy to the Budget Office. (In Boulder, the Director, NBS Boulder Laboratories will return the original signed copies to the initiating division and forward one copy each to PIO and the Fiscal Office.)

c. The Budget Office or Fiscal Officer, Boulder, will authorize establishment of the cost center and furnish the Office of the Comptroller with copies of the approved request.

d. If publication of proceedings by NBS is proposed, the publishing cost *must* be completely covered either by including this cost as part of the attendance fee, from MOU funds, from cosponsor contributions, or a combination of these sources.

9. Procedures, Costs Not Handled Through the Bureau Accounting System

a. Background

1. Conference funds may be managed by Bureau employees as part of their official duties only when the Bureau sponsors, cosponsors, or hosts the conference. Employees are not required to be responsible for conference funds, but may elect to handle such funds.

2. The Bureau's role must have the approval of the MOU director (in Boulder, the Director, NBS Boulder Laboratories).

3. If publication of proceedings by NBS is proposed, the publishing cost *must* be completely covered either by including this cost as part of the attendance fee, from MOU funds, from cosponsor contributions, or a combination of these sources.

4. Expenditures of nonappropriated funds should not benefit small groups or individuals. Particular discretion should be exercised in making payments or extending benefits to Bureau or Government employees for work in connection with a conference. Out-of-pocket expenses may be reimbursed; however, the accountable officer should seek the advice of the Comptroller on items which might be regarded as questionable, keeping in mind problems of conflict of interest and dual compensation.

b. Responsibilities¹

1. An accountable officer, designated by the NBS conference sponsor or cosponsor, is responsible for all receipts, commitments, and payment authorizations, and for preparing a final financial statement for review and possible audit. This person usually works with the conference chairperson or an executive committee to develop a budget and establish fees. An MOU may designate a single accountable officer to handle all its major conferences.

2. The accountable officer should keep records showing sources and expenditures of funds. The Comptroller may be contacted for advice on establishing such controls. Within 30 days of the completion of a conference or receipt of final bills, a financial statement and a copy of the final bank statement should be sent to the Comptroller (in Boulder, through the Fiscal Officer).

3. The Comptroller determines whether an audit will be made of the final financial statement prepared by the accountable officer.

c. Accounting for Funds

1. Commercial bank accounts must be established to receive fees and other contributions and to pay expenses of Bureau-sponsored or cosponsored conferences. For recurring conferences sponsored by the Bureau, continuing bank accounts may be maintained, and balances carried forward from one conference may be applied to the "start-up" costs of the next meeting (announcements, postage, etc.). For nonrecurring conferences, the bank account and any cash subaccounts are closed with the final statement. After all outstanding obligations for nonrecurring conferences have been liquidated, including publication of proceedings, balance remaining in the account will be deposited in the Gift and Honorarium Fund.

2. Payments may be approved by individual transaction, or through a budget approved by the conference chairperson and/or the MOU director. Individual payments can be approved by the accountable officer and one person connected with the function (generally the conference chairperson), with both signatures appearing on the documents substantiating payment. If there is an approved budget, the accountable officer may authorize and make payments without a second signature.

3. Records showing sources of funds and purpose of payments are maintained. Paid invoices, memorandums, and other documents supporting payments are retained and referenced to items appearing in the final financing statement.

¹If a cosponsor manages finances, these responsibilities do not apply. An NBS employee may not manage conference finances in the name of a cosponsor.

Exhibit 5-B. Copyright Release for Non-Government Authors, Form NBS-1158NBS-1158
(6-78)
UNITED STATES DEPARTMENT OF COMMERCE
National Bureau of Standards
 Washington, D.C. 20234

PUBLIC DOMAIN STATUS OF PAPERS PUBLISHED
By the National Bureau of Standards

Because the new U.S. Copyright Law, effective January 1, 1978, recognizes copyright in a manuscript at the time of preparation, it is important to establish a clear understanding of the conditions under which papers from non-Government authors may be accepted for publication by the National Bureau of Standards. The official NBS periodical and non-periodical series are supported in whole or in part by public funds and are printed by the U.S. Government Printing Office as "in-the-public-domain" publications. By law, official papers of NBS authors are not subject to copyright in the United States; and, thus, we impose no restrictions on their reproduction or use by the scientific and technical community or by abstract, microfilm, and other distribution services.

In order that "invited" papers by non-Government authors be subject to the same public policy considerations, we are asking authors whose papers will appear as part of the proceedings of conferences sponsored or cosponsored by NBS to dedicate their contribution to the public. Under this procedure, the public will be free to use the paper without restriction, thus following a practice found to promote the widest possible dissemination of scientific and technical literature. Your agreement to dedication in no way restricts your subsequent use of your paper. It is understood, therefore, that your signature below will signify your consent to the release of any copyright you may have in your contribution to these proceedings. To this end, please complete the following:

TITLE OF PAPER		
AUTHOR(S)		
MEETING/CONFERENCE DATE	SIGNATURE	DATE

RETURN TO:

_____ Building, Room _____
 National Bureau of Standards
 Washington, D.C. 20234

Exhibit 5-C. Checklist for Proceedings Editor

1. Has copyright release been received from non-Government authors by use of Form NBS-1158 which appears in exhibit 5-B?
2. Do all papers conform with NBS editorial policy and format?
3. Are pages of uniform length?
4. Are photographs clear and informative? (Original black-ink drawings or black-and-white glossies are preferred.)
5. Is lettering on illustrations large enough so that when reduced it will still be readable?
6. Is computer-generated type printed on the unruled side of the paper, with clear and precise impressions?
7. Have the individual papers authored by NBS personnel cleared the Editorial Review Board, complete with Forms NBS-114 and NBS-114A?
8. Do the entire proceedings have an overall abstract and key words?
9. Have the entire proceedings cleared the Editorial Review Board? Usually the proceedings editor need submit only the front material, provided step 2 has been carried out by the symposium committee or the proceedings editor.
10. Is a purchase requisition (Form NBS-10A) provided or a conference account check supplied to absorb the publishing costs?

Bibliography 5-A. Aids to Oral Presentations

Mambert, W. A., *Effective presentation: A short course for professionals*. New York: John Wiley and Sons, 1976, 316 p.¹

A helpful series of self-study units in planning and delivering oral presentations.

Manko, H. H., *Effective technical speeches and sessions: A guide for speakers and program chairmen*. New York: McGraw-Hill, 1969, 174 p.

Lively, well-written resource with much practical advice, such as how to prepare an auditorium for a meeting and the relative advantages of different types of visual aids. This book covers the three major aspects required for a successful technical meeting: preparation of lively speeches, organization of a successful technical meeting, and parliamentary procedures to keep any meeting orderly.

¹ NBS library has a copy.

Index

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Washington Editorial Review Board (WERB)
(Membership as of 26 September 1980)

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Robert F. Blunt, <i>Exec. Secy.</i>	344	Admin. A617	2058
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W. Reeves Tilley, <i>Mbr. Emeritus</i>	344	Admin. A530	2493

	Org.	Phone	Expiration of Appt.*
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John W. Cooper	520	2001	1982
R. Keith Kirby	503	2082	1981
Alvin Perloff	560	2900	1981
Charles M. Eisenhauer	530	2685	1981
Donald H. Tsai	540	2831	1982

NATIONAL ENGINEERING LABORATORY

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Dennis A. Swyt	730	2159	1981
Stephen T. Margulis	740	2102	1981
Robert S. Levine	750	3845	1981
Carl O. Muehlhause	760	3751	1981

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Robert Rosenthal	650	3516	1982

PUBLIC INFORMATION

Sharon A. Shaffer	346	3181	1981
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*Members serve 2 years; may be reappointed.

**Boulder Editorial Review Board (BERB)
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Ralph F. Desch, <i>Ex-Officio Mbr.</i>	360	1-4001	3244
	Org.	Phone	Expiration of Appt.*
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ELECTROMAGNETIC TECHNOLOGY DIVISION			
Richard L. Kautz	724	3391	1981
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Dwain E. Diller	773	3255	1981
Larry L. Sparks	773	3612	1982
TIME AND FREQUENCY DIVISION			
James L. Jespersen	524	3849	1982
FRACTURE AND DEFORMATION DIVISION			
Hassel M. Ledbetter	462	3443	1982

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Quantum Physics Division, U. of Colorado
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(Membership as of 1 October 1980)**

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Vacant (Chemistry)	
Andrew J. Fowell (Engineering)	3748
Joseph O. Harrison (Computer Science)	3551
Howard J.M. Hanley (Boulder Labs)	3320 (Bldr.)

NBS TECHNICAL PUBLICATIONS

PERIODICALS

JOURNAL OF RESEARCH—The Journal of Research of the National Bureau of Standards reports NBS research and development in those disciplines of the physical and engineering sciences in which the Bureau is active. These include physics, chemistry, engineering, mathematics, and computer sciences. Papers cover a broad range of subjects, with major emphasis on measurement methodology and the basic technology underlying standardization. Also included from time to time are survey articles on topics closely related to the Bureau's technical and scientific programs. As a special service to subscribers each issue contains complete citations to all recent Bureau publications in both NBS and non-NBS media. Issued six times a year. Annual subscription: domestic \$13; foreign \$16.25. Single copy, \$3 domestic; \$3.75 foreign.

NOTE: The Journal was formerly published in two sections: Section A "Physics and Chemistry" and Section B "Mathematical Sciences."

DIMENSIONS/NBS—This monthly magazine is published to inform scientists, engineers, business and industry leaders, teachers, students, and consumers of the latest advances in science and technology, with primary emphasis on work at NBS. The magazine highlights and reviews such issues as energy research, fire protection, building technology, metric conversion, pollution abatement, health and safety, and consumer product performance. In addition, it reports the results of Bureau programs in measurement standards and techniques, properties of matter and materials, engineering standards and services, instrumentation, and automatic data processing. Annual subscription: domestic \$11; foreign \$13.75.

NONPERIODICALS

Monographs—Major contributions to the technical literature on various subjects related to the Bureau's scientific and technical activities.

Handbooks—Recommended codes of engineering and industrial practice (including safety codes) developed in cooperation with interested industries, professional organizations, and regulatory bodies.

Special Publications—Include proceedings of conferences sponsored by NBS, NBS annual reports, and other special publications appropriate to this grouping such as wall charts, pocket cards, and bibliographies.

Applied Mathematics Series—Mathematical tables, manuals, and studies of special interest to physicists, engineers, chemists, biologists, mathematicians, computer programmers, and others engaged in scientific and technical work.

National Standard Reference Data Series—Provides quantitative data on the physical and chemical properties of materials, compiled from the world's literature and critically evaluated. Developed under a worldwide program coordinated by NBS under the authority of the National Standard Data Act (Public Law 90-396).

NOTE: The principal publication outlet for the foregoing data is the Journal of Physical and Chemical Reference Data (JPCRD) published quarterly for NBS by the American Chemical Society (ACS) and the American Institute of Physics (AIP). Subscriptions, reprints, and supplements available from ACS, 1155 Sixteenth St., NW, Washington, DC 20056.

Building Science Series—Disseminates technical information developed at the Bureau on building materials, components, systems, and whole structures. The series presents research results, test methods, and performance criteria related to the structural and environmental functions and the durability and safety characteristics of building elements and systems.

Technical Notes—Studies or reports which are complete in themselves but restrictive in their treatment of a subject. Analogous to monographs but not so comprehensive in scope or definitive in treatment of the subject area. Often serve as a vehicle for final reports of work performed at NBS under the sponsorship of other government agencies.

Voluntary Product Standards—Developed under procedures published by the Department of Commerce in Part 10, Title 15, of the Code of Federal Regulations. The standards establish nationally recognized requirements for products, and provide all concerned interests with a basis for common understanding of the characteristics of the products. NBS administers this program as a supplement to the activities of the private sector standardizing organizations.

Consumer Information Series—Practical information, based on NBS research and experience, covering areas of interest to the consumer. Easily understandable language and illustrations provide useful background knowledge for shopping in today's technological marketplace.

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